**Climate
of the Past
Discussions**

Interactive
Comment

Interactive comment on "Thermal log analysis for recognition of ground surface temperature change and water movements" *by* M. Verdoya et al.
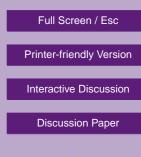
Anonymous Referee #3

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Referee Comment

I believe the authors have extracted as much information as possible from their available data set. I also believe this paper is scientifically acceptable because it is important contribution to the global data set of ground surface temperature (GST) histories. Especially, because it is complementary to the authors' previous publications, and is a substantial contribution to this part of Europe which is not so much covered with the GST histories results. The discussion paper is very good in overall quality.

Specific comments

The paper covers and addresses relevant scientific questions within the scope of Climate of the Past (CP). The paper mostly presents novel concepts, ideas and data,

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maybe not really novel tools. Scientific methods and assumptions are valid, but they are, at least for me, only partly clearly outlined. The results are sufficient to support the interpretations and conclusions, and substantial conclusions are reached, to my opinion.

Description of calculations is, to my feeling, not sufficiently complete to allow their reproductions by fellow scientists. The authors could have written down equations or formulae how POM temperature is practically calculated or perhaps just showed a graphical example and not only to resort to some references (e.g. Bodri and Cermak, 2003), at least for one borehole site as the example. In chapter (3) - "SAT data", first paragraph, the authors say that "details on data homogenisation, updating and improvement are scattered in several papers", and that they "performed additional tests by means of diagrams of year-by-year variability". They give reference on work by Bodri and Cermak (2003) for a description of the method. Couldn't they demonstrate at least one example of such variogram from their additional test, so as to see how efficient are such variograms ?

As described in chapter (4) - "Climate change reconstructions", first paragraph, the authors used the approach by Bodri and Cermak (2005) for the joint estimation of the POM temperature and the vertical velocity of fluid migration. They say that "POM temperature and fluid vertical velocity can be obtained by comparing the reduced temperatures with synthetic temperature logs calculated using SAT record". Couldn't they show graphically one example, how is this obtained? Can they explain more in detail how did they use the steepest descent algorithm to minimize the sum of squared differences between measured and calculated reduced temperatures? Or this is some kind of secret? Or perhaps, at least one example of the most reliable values of POM and ground water velocity that correspond to the minimum rms misfit could be done as an additional figure.

Authors could present how did they calculate the POMa temperature obtained with a conductive/advective model for the GH10 borehole as they write in subchapter (4.1)

on page 104, first paragraph, and related to what they described on page 102/103 in chapter (4), first paragraph.

On the other hand, the authors give proper credit to related work and they clearly indicate their own new contribution, which is maybe not quite original. The title clearly reflect the contents of the paper. Also the abstract provides a concise and complete summary. The overall presentation is well structured and clear, and the language is fluent and precise. The units are correctly defined and used. The number and quality of references are appropriate. Figure 2 should be more clarified, that is, temperature-depth profiles could be drawn greater if possible, and enriched or supplemented by extrapolated linear trend (drawn with thin lines) from the lowermost part to the T0 so as to support the results in Table 2 and to demonstrate how the standard linear regression technique is done, refering to page 100, first 4 lines. Is it just Treduced = Tobserved - Tlinear ? But perhaps this would make figures too complicated or stuffed up? The necessity for the temperature-depth profiles to be more clearly drawn is, for example, stressed following the text on page 104, third paragraph, "the POM value for GH12 is more than $1°C$ higher than that inferred for the other boreholes, probably due to a too high flow velocity (upward)". The figure 2 showing locations of boreholes and meteorological stations is so small and simplified, could be drawn a little bit greater if the coloured graphs are not acceptable?. From such a map one can not make a conclusion on the kind of microlocality for each borehole site, orientation, land use, etc. Only in conclusions the authors mentioned a variety of factors (page 109, line 17 and beyond), such as variations of the agricultural activity, vegetation cover and urbanization. Only for the borehole GH13 they said it was located in the rural area. What about the other borehole sites?

Nothing has been said about the possible influence of lithological heterogeneity and consequently different thermal conductivity on temperature-depth profiles' curvature from some boreholes. But maybe the authors are right and this issue can be neglected, because all boreholes penetrated more or less homogeneous strata, except

some minor lithological variations in GH12, GH14 and GH15.

Otherwise, the amount of supplementary material is appropriate, except as suggested above. It is, of course, on authors to decide whether they will add any figures or not.

Technical corrections

There are very few corrections as I noticed:

Page 104, first paragraph, line 3: "Noticeable downward flow was inferred in GH10 and GH12". According to Table 2 and negative value there for ground water velocity from GH12, it should be written: ...in GH10 and upward flow in GH12.

Page 106, subchapter 4.2, third paragraph, penultimate line 26: Ěincrease of 0.4-0.6 K until 1880,Ě When looking at Figure 5 this increase, I guess, presents the average increase of all three curves (GH1, GH13 (1982) and GH13 (2002) or something else. Otherwise it is only increase of about 0.26-0.45 K as I see from the figure.

Page 108, third paragraph, line 21: This find a confirmation alsoĚ It should be: This finds a confirmation alsoĚ

Page 109, second paragraph, line 18-19: The borehole GH13 located in a rural area,ĚIt should be: The borehole GH13 is located in a rural area,Ě

Page 110, last paragraph, line 19: It is also appears thatĚ It should be: It also appears thatĚ

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