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CPD

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Interactive Comment

Interactive comment on "Impact of maximum borehole depths on inverted temperature histories in borehole paleoclimatology" *by* H. Beltrami et al.

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In their recent paper Beltrami et al., (CP-2011-8) take on the problem of the impact of maximum borehole depths on inverted temperature histories in borehole paleoclimatology. While I agree with their conclusion I would like to say that they fail to mention similar results of the study published nine years ago by Majorowicz et al (2002).In that sense the conclusions of Beltrami at al., paper are not new(CP-2011-8)while the paper pretends to have this as the new finding.

I will remind readers the results of our published JGR 2002 analysis in our JGR 2002 paper's chapter 4 on the sensitivity test of borehole history to the lenght of the inverted temperature profile. The title of the Beltrami et al., (CP-2011-8) which is :"Impact of maximum borehole depths on inverted temperature histories in borehole paleoclima-

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tology" is simillar to Majorowicz et al., (2002) JGR paper chapter 4 title: "Sensitivity Test of Borehole History to the Length of the Inverted Temperature Profile" and both of these adress the same important problem.

Majorowicz et al., (2002, Fig.4a,b) did show a numerical experiments with synthetic T-z profiles. Synthetic T-z are truncated to various depths to attempt to quantify the potential bias between shallow western Canadian wells (150 m to 300 m in depth in the western Canada Sedimentary basin) and deeper eastern and central Canadian wells (300 m - 400 m in depth) (see Figs. 1-2 below). Data from shallow boreholes contain insufficient information to resolve the cooling trend that might have occurred during the Little Ice Age. This implies that the estimates for both the onset and the amplitude of the subsequent warming may also be biased.

The T-z profiles were calculated as a response to a linear increase of the surface temperature of 1.5 C over the period 1850-2000 and preceded by a constant temperature. This is the period for which instrumental surface air temperature data are available in Canada. Two diffusivity values were considered, 1.0*10-6 m**2s-1 (typical for central and east-central Canada) and 0.6*10-6 m**2s-1 (typical for the western Canada Sedimentary basin). The profiles, both noise free and noisy (Gaussian noise with SD=0.02C added) were truncated progressively to 600, 400, 250, 200, 150 and 100 m and inverted in the same way as the experimental profiles. It was found (se Fig. 1 and Fig.2 below) that the amplitude of warming is reasonably well reproduced for wells deeper than 200 m for the east-central Canada case and deeper than 150 m for the western Canadian Sedimentary basin case. It is related to 1.0 vs. 0.6 diffusivity (the Canadian shield granites and other crystalline rocks have higher diffusivity than shallow clastic sediments with large content of shales like in case of the Western Canadian Sedimentary basin where shallower wells were used).

Majorowicz et al., (2002) have therefore rejected shallower (<150m) wells from the analysis in the context of the study of recent pre-industrial and industrial warming. The above is supported by comparison of the GST histories derived from temperature logs in deep wells available in the Canadian prairies (wells deeper than 250 m, some as deep as 500m) with GST histories derived from temperature logs in wells 150 m – 240 m deep (Majorowicz et al., 1999). No significant differences were observed. It is also noted that despite large variations in depth of the analyzed wells in the west (well depths between 150m and 500m) the derived onset of the recent significant warming is almost the same for all (100m +/- 10m corresponding to 1880-1900) (Majorowicz et al., 2002, Fig. 2c). Experimental results also suggest that the onset of the warming is not well resolved by the individual inversions due to noise, although it's timing is possible to track. However, identifying events such as the onset of the Little Ice Age are not as precise.

Beltrami et al; (CP-2011-8)cite Majorowicz et al., (2002) and Majorowicz et al., (1999) papers only as papers which used shallow well's temperature logs to invert surface temperature history. They refer to Huang, and Pollack's (1998) NOAA/NGDC Paleoclimatology Program, Boulder, Colorado in the same context , i.e., as an example of use of shallow in their opinion temperature logs ((as shallow as 250m).

Their fail to mention that Majorowicz at al., 2002 JGR paper was the first to adress the problem of sensibility of inversions to the lenght of the inverted temperature logs and that the authors of that paper were aware of the problem of inverting shallow <250m temperature profiles in wells.

Fig. 1. FSI's of the synthetic profile based on the assumed GST history (line A) and truncated to various depths. Both noise free and noisy (SD=0.02ïĆř C) data were considered. Labels mark depth of the inverted profile. Diffusivity was assumed 1.0*10-6 m**2s-1 (typical for central and east-central Canada).

Fig. 2. FSI's of the synthetic profile based on the assumed GST history (line A) and truncated to various depths. Both noise free and noisy (SD=0.02ïĆř C) data were considered. Parameters of the inversions are the same as for the experimental data. Labels mark depth of the inverted profile. Diffusivity was assumed 0.6*10-6 m**2s-1

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(typical for western Canada Sedimentary basin) .

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Interactive comment on Clim. Past Discuss., 7, 715, 2011.

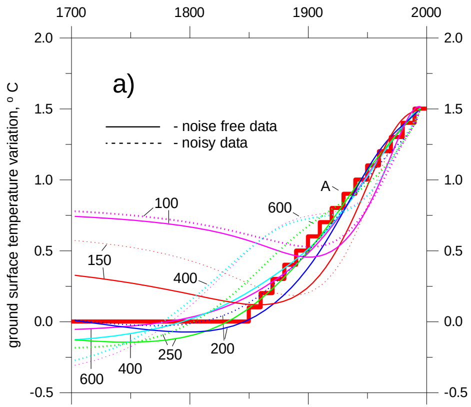

Fig. 1.

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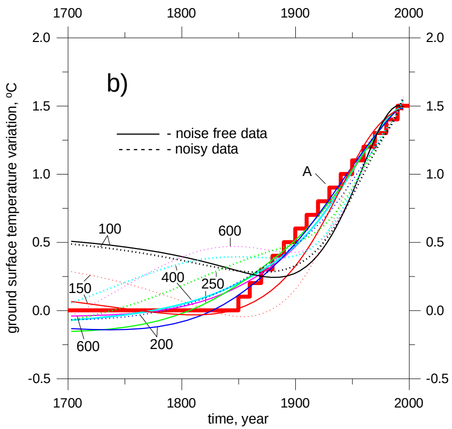
1700
1800
1900
2000
2.0
1.5
1.0
0.5
0.0
-0.5
b)
- noise free data
- noisy data
A
100
600
150
400
250
600
200
ground surface temperature variation, °C
time, year

Fig. 2.