

# ***Interactive comment on “Long-Term Global Ground Heat Flux and Continental Heat Storage from Geothermal Data” by Francisco José Cuesta-Valero et al.***

## **Anonymous Referee #2**

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Review of Cuerta-Valero et al Long-Term Global Ground Heat Flux and Continental Heat Storage from Geothermal Data

This paper represents a useful update and expansion of a large body of work that uses borehole temperature measurements to estimate surface temperature changes and accumulation of heat in the upper few hundred metres of the Earth’s crust, both associated with recent climate change.

Advances in the paper include (a) the addition of additional borehole temperature data, and (b) a new approach to the inversion of the borehole data that produces better estimates of the uncertainties.

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The introduction section is a particularly useful, comprehensive summary of work in this area with an extensive reference list.

Figure 3a, the updated ground temperature history from 1580 CE to present with uncertainty estimates is very important. It is shown in comparison to previous ground temperature histories and the meteorological record back to  $\sim 1900$  and should be widely used as a constraint in climate reconstructions. The authors perhaps should make a stronger point that Fig3a (and the analysis that results in Fig 3a) shows about 0.4K of warming from pre-industrial times to the start of the observational meteorological record around 1880. And the total land surface warming to present time (Fig 3a) is close to 1.4K.

In view of that number I don't understand the sentence in the conclusions that reads "The magnitude of the retrieved changes in ground surface temperature in this analysis supports the claim that the Earth's surface has warmed by  $\sim 0.7$  K since preindustrial times." Nor the sentence in the abstract that includes "land temperature changes of 1 K ... during the last part of the 20th century relative to preindustrial times." These statements should be consistent with each other and with Fig. 3a.

Attention to the following details would improve the manuscript. 1. In Eqn 1, R is not a thermal depth which would have dimensions of length. It is in fact the thermal resistance with units  $m^2 K / W$ . 2. In section 3.1, the criteria for accepting a borehole temperature log of 1 measurement in the 15-100m depth range and at least 3 measurements in the 250-310 m depth range seems pretty loose. It would be good to know why such a fairly lax criteria was chosen and how many sites creep into the data set as a result. 3. It is a personal style, but I would prefer fewer acronyms. Are the following all necessary: GHC, BTP, GSTH, GHFH, PPI, RMSE, PPIT?

Overall this paper is a very useful contribution to the climate change literature.

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