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Climate of the Past Discussions

Interactive comment on "Long-term Surface Temperature (LoST) Database as a complement for GCM preindustrial simulations" *by* Francisco José Cuesta-Valero et al.

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Review of "Long-term Surface Temperature (LoST) Database as a complement for GCM preindustrial simulations" By: Cuesta-Valero, et al.

General comments The development and improvement of climate models (GSM) is a leading scientific method for understanding the Earth's climate system and its forecasting. Despite considerable efforts in the development of these models, there remains a large uncertainty in GCM scenarios. Authors suggest a new Long-term Surface Temperature (LoST) Database as "a reference to narrow down the spread of surface temperature climatologies on GCM preindustrial control and past millennium simula-

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tions". Preindustrial (1300-1700) ground surface temperatures cover North America and obtained from borehole temperature profiles (BTP) analysis. A robust paleotemperature evaluation technique based on extrapolating the temperature profile from the interval 200-300 m to the Earth surface has been used. Unlike BTP inversion methods, this simple technique is not burdened by the uncertainties associated with the choice of the algorithm for the inverse problem solving, and provides comparable estimates of paleotemperatures. I suppose the paper describes a new and important result for the development of climatology and can be published in the CP.

Specific comments 1. The simplicity of the technique used does not obviate the need to justify it. Strictly speaking, the extrapolation of temperature profiles from the interval of 200-300 m provides a very approximate estimate of the mean ground surface temperature in 1300 - 1700. It is necessary to provide a justification or refer to the paper where it was done (for example, "First-order estimate of the GST history" technique by Pickler et al., 2016). First-order estimate technique is based on the use of formula (2), but its description"...the recorded temperature at a depth z can be related to an estimate of time (t)" is incorrect. Correctly: t is the time after which the temperature anomaly dT appeared at the surface reach 0.16dT at a depth of z and 0.005 at a depth of 2z. Therefore, if we assume that 0.16 dT is a negligible part of the anomaly, we should replace the description on Figure 1

from: z = 300 m -> t $\approx$ 1300, z = 200 m -> t $\approx$ 1700

to: z = 300 m -> t > 700 years ago, z = 200 m -> t >300 years ago

2. A large sample of BTP data was used. Obviously, many temperature profiles revealed evidences of non-climatic influences within the studied interval (hydrogeology, heterogeneity of thermal properties). Did the authors select (or correct) the initial data and by what criteria?

3. P2,L32-34: "...BTP measurements have been employed to estimate ... surface flux histories over the last centuries (e.g., Beltrami, 2002; Beltrami et al., 2002, 2006)".

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Here the authors refer only to themselves. Meanwhile, the possibility of estimating the surface heat flux changes from ground surface temperature changes was formulated by Wang, and Bras (1999). With regard to borehole temperature data, this technique (besides the mentioned papers) was developed in (Huang, 2006; Demezhko and Gornostaeva.2015a,b). In the last two papers an alternative measure of the Earth's climatic sensitivity has been proposed as the ratio between the ground surface flux changes and external fluxes changes. I believe that estimates of preindustrial surface heat flux changes can also be useful for GCM simulations, as well as estimates of paleotemperatures. I would like the authors to raise this question in the "Discussion" section.

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