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Climate of the Past Discussions

Interactive comment on "Surface thermal perturbations of the recent past at low latitudes - inferences based on borehole temperature data from Eastern Brazil" *by* V. M. Hamza et al.

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Reply to Comments by Referees

We are thankful to the comments and suggestions made by referees (1) and (2). These have contributed to significant improvements in the revised version of the manuscript. The data set has been revised and some new and deep borehole data introduced. Most of the data reported are for boreholes with depths greater than 200 meters. Some log data for depths less than 200 meters are also considered, as they provide complementary information on GST variations encountered in deeper boreholes of the same general area. Figures (1) and (2) have been merged to a single one in the revised version. Similarly, the separate parts of Tables (2abc) and (3abc) have been merged into

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new tables 2 and 3 respectively. Also, figures (3abc) and (4abc) have been merged into new figures (3) and (4) respectively. As per recommendation, the figures of air temperature data have been deleted. There are some slight modifications in the description of the methods employed. The text also points out the strong and weak points of the models considered, taking care to avoid reproducing textbook stuff. The forward models are referred to in the revised version as the Classical Inversion Method. The other one (Functional Space Inversion) is described as the Bayesian Inversion method. We hope that the explanation provided below may contribute to clear up any eventual misunderstandings.

Reply to Referee 1 We share the concern expressed about the depth ranges of temperature data used in the present study. The importance of data from deeper holes (when these are available) cannot be underestimated. On the other hand, we note that out of 17 boreholes selected in the present work, 11 have depths in the range of 200 to 500 meters, while six have depths in the range of 150 to 200m. Such ranges are comparable with those employed in many geothermal climate studies of the past (see for example, Lachenbruch et al, 1982); and also recent (Roy et al, 2002; Majorowicz et al, This Volume). In this context, it is convenient to note that the main focus of the present work is on examining climate changes of the last 100 to 200 years. Data from deeper sections of some of the boreholes have been omitted in figure (3). This practice retains clarity in presentation. As for the results of functional space inversion, we also share the concern expressed about the time scale for climate history. In the revised version we have limited the time period for shallow boreholes (depths less than 200 meters) to the last 250 years. Time periods extending to 1500 years is considered only for boreholes with depths greater than 300 meters. However, it is important to point out that parts of climate signals of the earlier time periods are also present at shallower depth ranges. This point was made by Birch (1948) in his classic work on corrections (based on “recollection indices”) for the effects of Pleistocene glaciations. As for air and soil temperature data we agree with the comment that these may contain also effects of urban growth effects of the last century. Unfortunately most of the

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available meteorological data are from locations within or close to main urban areas. On the other hand, according to Hansen and Lebedeff (1987) the correlation lengths of SAT data are of the order of 500km, much in excess of the spatial dimensions of urban areas. The “small scale cooling trends” of the last few decades, visible in analysis of GST deviations, are probably indicative of small cooling trend of the decades of 1970 and 1980. In this context it is convenient to note that results reported by Lachenbruch et al (1986; 1988) also point to similar cooling trends for the period of 1950 to 1970, in Arctic Alaska. Nevertheless, the possibility that it is a consequence of near surface conditions and/or processes unaccounted for in the formulation of the models, cannot entirely be ruled out. This trend can be removed by setting a slightly deeper depth level for data used in inversion. However, we have retained them for the sake of consistency, in setting the model grid elements used in functional space inversion.

Interactive comment on Clim. Past Discuss., 3, 501, 2007.