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Which boreholes do we need to resolve the Common Era in borehole paleoclimatology?

V. Rath (1), J. E. Smerdon (2), J. F. González-Rouco (1), and H. Beltrami (3)

(1) Universidad Complutense de Madrid, Fac CC Físicas, Departamento de Física de la Tierra, Astronomía y Astrofísica, Madrid, Spain (vrath@fis.ucm.es), (2) Lamont Doherty Earth Obs., Columbia University, New York, NY, USA, (3) Department of Earth Sciences, St. Francis Xavier University, Antigonish, NS, Canada

The global database of borehole temperature profiles used to estimate paleoclimatic ground surface temperature histories (GSTHs) has typically focused on the last 500 years. his is mainly due to the fact that the borehole database is dominated by shallow boreholes (∼200-300 m). Nevertheless, it has been shown that these boreholes may be too shallow for proper separation of the downwelling climatic transient and the long-term background steady-state signal associated with heat loss from the earth's interior. The mere inclusion of deeper boreholes, however, does not necessarily mitigate the problem. Borehole temperature profiles of any depth show the signatures of earlier climatic changes, including the strong warming following the last glacial maximum (LGM). In shallow boreholes this effect is very similar to a linear trend, usually cannot be discriminated from a steady-state geotherm, and is unlikely to strongly impact estimates of GSTHs spanning common-era timescales. In deeper boreholes, however, the signature of the LGM cannot be approximated linearly, and biases associated with the LGM may impact GSTH reconstructions during the Common Era. The combined incentive to employ deep boreholes for reliable estimation of the background steady-state signal, while limiting the LGM impacts on reconstructions of Common-Era GSTHs thus leads to an multi-objective optimization problem seeking a trade-off between the impacts of the two effects. Such an optimization of the borehole maximum depth criterion is investigated in this study using numerical models. A Monte Carlo ensemble approach is used to quantify the impact of various reconstruction decisions as temperature histories, error characteristics, thermophysical properties, and maximum borehole depths. The findings have implications for interpretations of current global reconstruction products and future efforts to analyze the global borehole database for Common-Era GSTH reconstructions.
(http://palma.fis.ucm.es/∼volker/)