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Long-term ground surface temperature from geothermal data in North America as a complement for GCM control simulations

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Control climate simulations aim to provide a stationary state to General Circulation Models (GCMs) under constant preindustrial conditions (piControl simulations). This stationary state is then used as initial conditions in GCM simulations to provide a stable and realistic climatology, reducing the potential bias in such simulations. However, it is difficult to provide a reference to assess the climatology of piControl simulations due to the lack of long-term preindustrial observations. We explore the use of long-term ground surface temperature estimates from borehole temperature profiles as an additional reference that may be useful for the initialization procedure of GCM simulations.

We compare estimates of long-term preindustrial ground surface temperatures from 514 borehole temperature profiles over North America against five Last Millennium (LM) simulations and five preindustrial control simulations from the third phase of the Palaeoclimate Modelling Intercomparison Project (PMIP3) and the fifth phase of the Coupled Model Intercomparison Project (CMIP5) archive. Our results suggest that the ground surface temperature estimates from borehole data could be employed as a reference within piControl simulations to enhance the quality of the initial conditions in GCM climate simulations.