



Simulation and inversion of borehole temperature profiles in surrogate climates: a method assessment

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Simulations with General Circulation Models (GCMs) can be used as a substitute for the real climate evolution in order to test methods and assumptions in climate reconstruction approaches. In this work, the borehole climate reconstruction method is replicated within the millennial climate simulations produced with the ECHO-g ocean-atmosphere GCM. A heat conduction forward model is driven by simulated surface temperatures and used to produce underground temperature perturbation profiles. An inversion model is applied to reconstruct ground surface temperature histories from the simulated profiles and to compare with the climate model temperatures.

Results obtained with this approach allow for testing several hypothesis and potential caveats of the borehole method of climate reconstruction. Inversion models seem to perform adequately in retrieving long term trends in the millennial simulated GCM temperature. The irregular and in places sparse distribution of borehole sites appears to be a sufficient sampling for NH terrestrial surface air temperature trends. The procedure is used to illustrate the effects of various uncertainties affecting borehole climatology like surface coupling, dating and depth irregularity.