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Uncertainty in simulated borehole temperature profiles: relevance for comparison with observational evidence.

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Joint analysis of paleoclimatic reconstructions, model simulations and estimates of past external forcing can reveal the degree of agreement between model results and reconstructions, and provide a measure of confidence on a range of projections of future climate change. These may also allow for constraining the range of climate sensitivity and to attribute past changes found in millennial climate reconstructions to external forcings. Advances in convergence between simulation and reconstruction approaches require progress in understanding the uncertainty on both ends; comparisons are in practice subjected to the particularities of each proxy type and limitations inherent to model simulations. Comparisons between borehole climate reconstructions and model simulations suffer from uncertainty concerning the influence of past glacial and Holocene changes in the top ca. 0.5 km of the subsurface. Recent studies suggest that this can be addressed through the incorporation of a probabilistic approach that samples the parameter space producing ensembles of synthetic borehole temperature profiles (BTPs) that can be compared to observed BTPs. The contribution of past glacial and Holocene variability to uncertainty in the comparison between observed and simulated BTPs in the uppermost ca. 0.5 km of the subsurface is explored using last-millennium and Holocene duration control and forced simulations from ECHO-g

and LOVECLIM models, respectively. The simulated temperature histories are randomly sampled to produce ensembles of synthetic BTPs that incorporate different slices of past climate history. A discernible influence from glacial and interglacial changes in the uppermost ca. 0.5 km of the ground is shown. Also, the sensitivity of parameters used in the comparison of simulated and observed BTPs to past climatic variations is explored.