Is it possible to constrain climate sensitivity by comparing simulated and observed borehole temperature profiles?

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An ensemble of simulations has been performed over the last 1000 years with the Earth system of intermediate complexity LOVECLIM in which we have activated only the atmospheric (ECBILT), ocean-sea-ice (CLIO) and vegetation (VECODE) components. Thus, the model version used here is similar to ECBILT-CLIO-VECODE version 3. For this ensemble of simulations, we use different parameters sets in order to create 4 different versions characterized by climate sensitivities in the range 2-4 K, corresponding roughly to the range of the climate models simulations performed in the framework of the IPCC fourth assessment report. A standard set of reconstructions of changes in external forcing factors (solar variability, volcanoes, greenhouse gases, sulphate aerosols, land cover) over the last millennium have been used to drive all the model versions. In addition, for solar forcing and for the forcing associated with changes in sulphate aerosols load, several available reconstruction alternatives were considered. For each of those simulations borehole temperature perturbation profiles are simulated with a forward model using surface air temperatures at land grid-points as boundary surface conditions. The resulting profiles are compared to observed borehole profiles compiled by the International Heat Flow Commission. The model-data comparison provides information on the forcing/sensitivity combinations that are compatible (or not) with ground temperature observations as well as on the combinations that appear the most realistic compared to those observations.