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Improving climate change predictions by the use of paleo-data?

T. Schneider von Deimling, H. Held, A. Ganopolski, S. Rahmstorf
Potsdam Institute for Climate Impact Research (PIK), Germany, schneider@pik-potsdam.de

Recent studies have shown that it is not possible to crucially reduce the uncertainty range of climate sensitivity (CS) by using historical warming data or present day climatology. Alternative approaches comprise the use of paleo-data, ideally from a period with a radiative forcing and global mean temperature pronouncedly different to modern day climate, such as the Last Glacial Maximum (LGM, 21kyrs B.P.). We present a large ensemble of LGM simulations, performed by a fully-coupled model of intermediate complexity (CLIMBER-2). For this purpose we have simultaneously perturbed 11 model parameters that strongly affect the feedback strengths. We then use paleo-data from the tropics and from Antarctica to constrain the set of models being consistent with the glacial climate. When accounting for uncertainty in model physics, in the glacial forcing and in the paleo-data we infer a range of CS close to the IPCC estimate of 1.5-4.5°C.

We further present an analysis of the simulated feedback strengths regarding water vapour, clouds, lapse rate and albedo. We compare our inferred feedback strengths with recent GCM results and discuss the important issue of asymmetry in the feedback strengths between glacial and 2xCO2 conditions by focusing on model results from the PMIP-2 project.