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# Evaluation of simulated climate variability since the Last Glacial using climate models of varying complexity

**Elisa Ziegler** and Kira Rehfeld
Heidelberg University, Institute of Environmental Physics, Germany (eziegler@iup.uni-heidelberg.de)

The climate's mean state reflects only part of the changing climate and how it affects everyday lives. Understanding the climate's variability is crucial to provide more reliable simulations and projections, but temporal and spatial variability patterns and how they are related to changes in the mean state remain unclear. Here, we examine changes in variability since the Last Glacial in response to the warming of the global climate by several degrees. The analysis uses simulations from climate models of different complexity: a two-dimensional energy balance model (TransEBM), an earth system model of intermediate complexity (LoveClim), and a general circulation model (HadCM3). We analyse the simulated variability with respect to the different processes and parameterizations included in the different models and compare the temporal and spatial patterns that emerge. Commonalities as well as differences between models and how they relate to the changing mean state show that fast, low complexity models can capture a range of features of a climate variable's development, but also where such reduced descriptions fall short. As such, the results offer implications for the complexity that is needed and sufficient in parameterizations of climatic processes. Furthermore, we envisage that a comparison to paleoclimate archives can provide limits on the temporal and spatial scales that dominate the variability of climate.