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Simulating extreme glaciation/deglaciation events using a coupled climate – ice sheet model

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In our study, we present new model simulations with a recently developed three-dimensional coupled climate – ice-sheet model (LOVECLIM – Penn State University ice-sheet model) covering the period from 240 thousand years ago (ka) to 170ka (MIS 7 to MIS 6). A series of initial sensitivity experiments reveals the presence of multiple climate – ice-sheet equilibria and run-away effects. To overcome unrealistic ice-sheet growth, we adjust several global parameters (such as climate sensitivity etc.) and enhance the basal sliding coefficient over the Hudson bay. Our simulations suggest such regional scale adjustments to affect the global response to orbital variations and to be crucial for realistically simulating the amplitude of extreme glaciation events. We also investigate the independent effects of orbital and GHG forcings during this period. More realistic simulations also show the emergence of millennial scale variability. We further test the hypothesis that millennial-scale dynamics play a pivotal role in ice-sheet growth/decay on orbital timescales. Additionally, the impact of internal instabilities in huge ice sheets on extreme deglaciation events is investigated.