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# Transient simulations of the last 22,000 years, with a fully dynamic atmosphere in the GENIE earth-system framework.

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This paper presents and discusses an ensemble of transient model simulations from the Last Glacial Maximum to present-day. The model includes a fully dynamic, primitive-equation atmosphere (the Reading IGCM), computed vegetation (TRIFFID), and a slab-ocean and seaice. The atmospheric model is more akin to a low-resolution GCM than traditional EMICS, and yet is fast enough for long ensemble simulations to be carried out. The model is tuned in a purely objective manner, using a genetic algorithm, which perturbs 30 tunable paramters in the model to find the best fit to a prescribed pre-industrial climate.

The control deglaciation experiment has good agreement with data at the Last glacial Maximum and mid-Holocene. The deglaciation ensembles are over initial conditions, physical processes, and tunable model parameters. The ice-sheets are prescribed, and changes in oceanic heat transport are neglected, and yet the model exhibits rapid transitions in many of the ensemble members. These are attributable to the interaction of the dynamic atmsophere with the seaice, and are not observed when the ocean and seaice surface temperatures are prescribed. The timing of these transitions is sensitive to the initial conditions, pointing to the chaotic nature of the climate system.

The simulations have been carried out making use of GRID technologies, developed as part of the GENIE project.