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Towards a fully coupled climate–ice sheet model for simulating the climate of the Last Interglacial

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We use the recently released LOVECLIM1.3 model (www.climate.be/loveclim) to perform simulations of the climate of the Last Interglacial, between 130 and 115 kyr BP. Two options of the code are activated, i.e. an improved representation of tropical dynamics and a parameterisation of katabatic winds. Changes in atmospheric greenhouse gas concentrations and orbital parameters are used to drive the model in a transient simulation. The simulated global annual mean surface temperature peaks at around 128 kyr BP and then continuously decreases until a 'rapid event', which occurs at around 120.5 kyr BP. Then the model falls into another state characterised by a higher variability.

Here, we assess how much changes in the experimental setup affect the overall results. First, we show that changes in the configuration (extension and altitude) of the Greenland ice sheet do not significantly influence the major global patterns of climate change. Second, we use different parameter sets (adjustable parameters of the model), which leads to slightly different climate sensitivities or responses to a freshwater perturbation applied in the North Atlantic Ocean. The change in global annual mean surface temperature exhibits a similar pattern through time in all experiments but its magnitude depends on the parameter set used. By contrast, the time evolution of the maximum value of the Atlantic meridional overturning streamfunction appears very dependent on the parameter set. Third, we test the response of the model to a prescribed evolution over time of the extent and the elevation of Northern Hemisphere ice sheets. In particular, the magnitude of the change in global annual mean temperature and the timing of the Last Interglacial climate optimum are discussed.