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Glacial Inception in an Earth System Model

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We investigate the climate changes at the end of an interglacial by use of the Earth system model of intermediate complexity CLIMBER-2.3. The model is driven by changes in insolation and atmospheric CO2 content from 128 to 100 kyr BP. In our transient run, the last glacial inception in terms of a rapid ice-sheet growth in North America takes place at about 117.5 kyr BP. The sea-level change at the last glacial inception amounts to about -40 m as maximum in our simulation. The following forcings and physical feedbacks are discussed.

CO2 and insolation: According to our model, changes in insolation are crucial for the simulation of the last glacial inception. Changes in CO2 amplify the global cooling but cannot initiate ice-sheet growth itself.

Orbital parameters and calendar definition: We show that precession (more precisely, the day of perihelion) is the crucial orbital parameter for glacial inception in our transient run. The definition of the seasons has an impact e.g. on the calculated onset and amplitude of the African monsoon.

Impact of ocean and vegetation changes: Feedback from a changing vegetation and ocean are crucial for the simulation of a glacial inception. When we fix the state of the Earth's surface in our transient run to conditions reflecting a warmer climate (e.g. Eemian), glacial inception can be suppressed in our model.

Other glacial inceptions (MIS 7; 9; 11): With our model, we are able to reproduce glacial inceptions at the end of MIS 7, 9, and 11 as well.