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Transient simulations of the last deglaciation with interactive carbon cycle using CLIMBER-X

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The processes leading to the observed atmospheric CO2 variations of ~80 ppm between glacial and interglacial times associated with the glacial cycles of the past million years are still not fully understood. Computationally efficient Earth system models are a unique tool to help elucidate the mechanisms behind the CO2 variations. Here we use the newly developed Earth system model of intermediate complexity CLIMBER-X to explore the effect of different processes on the atmospheric CO2 evolution since the last glacial maximum using transient simulations.

CLIMBER-X includes the frictional-geostrophic 3D ocean model GOLDSTEIN coupled to the HAMOCC ocean and sediment carbon cycle model, the semi-empirical statistical-dynamical atmosphere model SESAM and the land model PALADYN. The model also includes the ice sheet model SICOPOLIS, but for in presented experiments the ice sheets are prescribed from reconstructions. CLIMBER-X can simulate ~10,000 model years per day.

In transient experiments of the last 20,000 years we test the sensitivity of simulated atmospheric CO2 to changes in ocean circulation, ocean temperature, sea level, atmospheric dust deposition and the model representation of crucial ocean biogeochemistry and land carbon cycle processes.