



## **Exploring the effect of changes in ocean circulation and biogeochemistry on Last Glacial Maximum atmospheric CO<sub>2</sub> concentration with CLIMBER-X**

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The processes leading to the observed CO<sub>2</sub> decrease of ~80 ppm during the Last Glacial Maximum compared to preindustrial are still not fully understood. Here we use the newly developed Earth system model of intermediate complexity CLIMBER-X to explore the effect of different ocean-related processes on the atmospheric CO<sub>2</sub> concentration at the last glacial maximum using time-slice 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. A one-box model is used to prognostically derive atmospheric CO<sub>2</sub>. In time-slice experiments we test the sensitivity of simulated atmospheric CO<sub>2</sub> at the last glacial maximum to changes in ocean circulation, temperature, volume, atmospheric dust deposition and the model representation of crucial biogeochemical processes. We additionally run transient simulations over the last glacial cycle to assess whether the carbon cycle at the last glacial maximum can be assumed to be in steady state.