

Climate sensitivity and response to glacial forcing in the CESM-CCSM4

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We investigate the response of the Community Climate System Model, version 4 (CCSM4) to the climate forcings of the Last Glacial Maximum (LGM) 21,000 years ago. A 1000 year long CMIP5 simulation is run with full LGM forcings and boundary conditions, following the PMIP3 protocols, at the standard 1-degree resolution in all model components (LGM). Vegetation was prescribed as preindustrial, but the carbon-nitrogen biogeochemistry model in CLM4 allows the vegetation phenology to adjust to the climate state. Compared to the CMIP5 1850 preindustrial control simulation, global mean annual surface temperature cools by $\sim 5.0^{\circ}\text{C}$ by the end of the integration in good agreement with proxy evidence. A separate 1100 year long simulation was performed with CO₂ lowered to glacial levels (LGMCO₂) in order to separate out the response to lowered CO₂ from the response to full glacial conditions. This simulation suggests that about half of the global LGM cooling is due to the lowered CO₂. In addition, we compare the global climate sensitivity to glacial forcing to the climate sensitivity in a CMIP5 multi-century simulation in which the atmospheric CO₂ is abruptly increased to 4 times its preindustrial value (4xCO₂). We will discuss the effect of some of the climate responses to the different forcings on the climate sensitivity.