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Warm Climate States during Last Glacial Cycle with a Multi-Resolution Climate/Ice Sheet Model

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Interglacials during the Quaternary represent the youngest climate states in the paleoclimate record that are similar to potential warmer-than-present states during the Anthropocene. In particular, those periods with warmer reconstructed temperatures and/or higher sea levels provide insights into the mechanisms that may be at work now and in the future. To date, climate model simulations of Quaternary Interglacials have been restricted to Atmosphere-Biosphere-Ocean simulations, with static ice sheet geometries from glaciological, geological, and geophysical reconstructions. Simulations including fully interactive ice sheets have not been widely available. Here, we present the first simulations of the PMIP4 timeslices for the Holocene and the Last Interglacial (LIG) with a fully coupled multi-resolution climate/cryosphere model, the AWI-ESM. We compare the simulated snapshots for the Holocene and LIG to simulations to proxy reconstructions, and to runs without dynamic ice sheets to highlight the processes now represented by the improved model. Furthermore, we show various schemes implemented in our model system to represent the ice sheet mass balance, both from surface ablation as well as ocean interaction. We find that both the Holocene and Last Interglacial ice sheets contain a smaller volume of ice compared to present day, with relative sea level equivalent changes of -3% and -7%, respectively.