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Large-scale features of Last Interglacial climate: Results from evaluating the lig127k simulations for CMIP6-PMIP4

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The modeling of paleoclimate, using physically based tools, is increasingly seen as a strong out-of-sample test of the models that are used for the projection of future climate changes. New to CMIP6 is the Tier 1 lig127k experiment, designed to address the climate responses to stronger orbital forcing than the midHolocene experiment, using the same state-of-the-art models and following a common experimental protocol. We present a multi-model ensemble of 17 climate models, all of which (except for two) have also completed the CMIP6 DECK experiments. The Equilibrium Climate Sensitivity (ECS) of these models varies from 2.1 to 5.3°C. The seasonal character of the insolation anomalies results in strong warming over the Northern Hemisphere (NH) continents in the lig127k ensemble as compared to the piControl in June-July-August and a much-reduced minimum (August-September) summer sea ice extent in the Arctic. The multi-model results indicate enhanced summer monsoonal precipitation and areal extent in the Northern Hemisphere and reductions in the Southern Hemisphere. These responses are greater in the lig127k than midHolocene simulations as expected from the larger insolation anomalies at 127 ka than 6 ka.

New syntheses for surface temperature and precipitation, targeted for 127ka, have been developed for comparison to the multi-model ensemble. The lig127k model ensemble and data reconstructions are in good agreement for summer temperature anomalies over Canada, Scandinavia, and the North Atlantic and precipitation over the Northern Hemisphere continents. The model-data comparisons and mismatches point to further study of the sensitivity of the simulations to uncertainties in the specified boundary conditions and of the uncertainties and sparse coverage in current proxy reconstructions.

The CMIP6-PMIP4 lig127k simulations, in combination with the proxy record, have potential implications for confidence in future projections of monsoons, surface temperature, Arctic sea ice, and the stability of the Greenland ice sheet.

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