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Arctic sea ice at 127 ka: data compilation and CMIP6 model results

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The Last Interglacial period (LIG) is a period with increased summer insolation at high northern latitudes, which results in strong changes in the Arctic cryosphere. Understanding the mechanisms for this response via climate modelling and comparing the models' results to climate reconstructions are among the objectives of the Paleoclimate Modelling Intercomparison Project for its contribution to the sixth phase of the Coupled Model Intercomparison Project. Here we analyse the results from 16 climate models in terms of Arctic sea ice. To evaluate the model results we synthesise LIG sea ice data from marine cores collected in the Arctic Ocean, Nordic Seas and northern North Atlantic. The reconstructions for the northern North Atlantic show year-round ice-free conditions, and most models yield results in agreement with these reconstructions. Model–data disagreement appear for the sites in the Nordic Seas close to Greenland and at the edge of the Arctic Ocean. The northernmost site with good chronology, for which a sea ice concentration larger than 75 % is reconstructed even in summer, discriminates those models that simulate too little sea ice. However, the remaining models appear to simulate too much sea ice over the two sites south of the northernmost one, for which the reconstructed sea ice cover is seasonal. Hence models either underestimate or overestimate sea ice cover for the LIG, and their bias does not appear to be related to their bias for the pre-industrial period. Drivers for the inter-model differences are different phasing of the up and down short-wave anomalies over the Arctic Ocean, which are associated with differences in model albedo; possible cloud property differences, in terms of optical depth; and LIG ocean circulation changes which occur for some, but not all, LIG simulations. Finally, we note that inter-comparisons between the LIG simulations and simulations for future climate with moderate CO_2 increase show a relationship between LIG sea ice and sea ice simulated under CO_2 increase around the years of doubling CO_2. The LIG may therefore yield insight into likely 21st century Arctic sea ice changes using these LIG simulations.