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Information on the early Holocene climate constrains the summer sea ice projections for the 21st century

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Abstract. The summer sea ice extent strongly decreased in the Arctic over the last decades. This decline is very likely to continue in the future but uncertainty of projections is very large. An ensemble of experiments with the climate model LOVECLIM using 5 different parameter sets has been performed to show that summer sea ice changes during the early Holocene (8 kyr BP) and the 21st century are strongly linked, allowing for the reduction of this uncertainty. Using the limited number of records presently available for the early Holocene, simulations presenting very large changes over the 21st century could reasonably be rejected. On the other hand, simulations displaying low to moderate changes during the second half of the 20th century (and also over the 21st century) are not consistent with recent observations. Using this very complementary information based on observations during both the early Holocene and the last decades, the most realistic projection with LOVECLIM indicates a nearly disappearance of the sea ice in summer at the end of the 21st century for a moderate increase in atmospheric greenhouse gas concentrations. Our results thus strongly indicate that additional proxy records of the early Holocene sea ice changes, in particular in the central Arctic Basin, would help to improve our projections of summer sea ice evolution and that the simulation at 8 kyr BP should be considered as a standard test for models aiming at simulating those future summer sea ice changes in the Arctic.

[Final Revised Paper](#) (PDF, 806 KB) [Discussion Paper](#) (CPD)

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