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Does the absence of sea ice in the Arctic have an influence on the occurrence of extreme events over the Eastern part of Canada?

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The current rate of greenhouse gas emissions continues to increase, and climate models and observations show that climate changes are accelerating in response to these emissions. In this context, the rate of climate change has the potential to influence the frequency and the intensity of extreme events. At the same time, global warming will significantly decrease high-latitude sea ice extent, with the potential of summer ice-free conditions in the Arctic ocean within the next few decades. This decreased sea-ice extent will lead to amplified warming in these regions, which could have an additional, potentially non-linear, impact on the intensity of extreme events. But no robust link has been made between decreased ice coverage and extreme events at mid-latitudes. In this study, we aim to quantify the relationship between ice-free conditions in summer and extreme events in the context of continued global warming. We identify a sub-ensemble of ice-free summers in the CanESM2-LE large ensemble through clustering methods (7,500 years of simulations), matched with a complementary sub-ensemble of summers with Arctic sea ice. We also investigate the corresponding sub-ensembles of the ClimEx project (dynamically downscaled CanESM2 simulations on the Eastern part of Canada) to evaluate how and to what extent sea ice modes can influence regional extreme events during the following months (e.g. extreme precipitation, cold waves and heat waves). The large number of simulations in these ensembles allows to isolate the influence of sea ice from other modes of variability, as well as the effect of global warming itself. In the framework of climate services, this work will improve seasonal predictability and give additional insights on climate risk.