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Modelling the impacts of a dipole-like climatic state over the Arctic

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The Arctic dipole anomaly (ADA) features a pattern with opposite sea-level pressure anomalies over the Canadian Archipelago and the Barents Sea. Changes in the predominance of Arctic atmospheric circulation modes and the shift towards a dipole mode in the past decade played a role in the summer sea ice loss and sea ice-freshwater export from the Arctic to the North Atlantic. Reconstruction of sea ice cover variations during Holocene also suggests opposite anomalies in the Barents Sea versus either the western Arctic or the Fram Strait area similar to the ADA pattern. It is vital to study such physical processes that cause dramatic changes in the Arctic sea ice recalling the link between the ADA and the current climate change. Here we focus on the question of how a persistent ADA-like state affects the Arctic sea ice distribution and its outflow to the Atlantic Ocean. For this purpose, an eddy-permitting regional configuration of the NEMO coupled ocean/sea-ice model is used. The regional domain covers the Arctic Ocean and the Northern-Hemisphere Atlantic, with a horizontal resolution of 1/4 degree at the equator (ANHA4). For the present-day simulations, boundary conditions are obtained by taking the average over the years with a positive ADA and those with a negative ADA. In the Holocene scenario, global climate model data are used to force our regional model. To exclude the role of Bering Strait and the heat flux from the Pacific Ocean, we repeat the experiments with a closed Bering Strait since a nearly closed Bering configuration was possible for the Early Holocene. The model results are compared with the paleoclimate data from Arctic and subarctic seas.