Barents-Kara sea-ice decrease caused by sea surface warming in the Gulf Stream

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Abstract

In the past decades, the winter Arctic sea-ice has pronouncedly decreased in the Barents-Kara Sea. Barents-Kara sea-ice anomalies significantly impact the Arctic and mid-latitude climate variability through increased heat release to the atmosphere. However, the past sea-ice decline rate is underestimated in many CMIP6 earth system models, and the cause is still unclear. This study shows that climate model simulations can reproduce the Barents-Kara sea-ice concentrations (SICs) trend for 1970–2017 better than the multimodel mean of the CMIP6 historical simulations when sea surface temperature (SST) variability in the Gulf Stream region is constrained by observations. Furthermore, the observed sea surface warming of the Gulf Stream enhances the sea-ice decrease through a dynamic ocean process that transports excess heat from the Gulf Stream region to the Barents-Kara Sea at the surface layer. We also analyzed CMIP6 large ensemble and found that the linear trends between the Barents-Kara SIC and Gulf Stream SST increase explains 56% of the forced Barents-Kara SIC trend. We believe that this study suggests that future warming of the Gulf Stream can be an essential pacemaker of the sea-ice decline.

Keywords: Sea ice, Barents Kara Sea, Gulf Stream, CMIP6, Large ensemble

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