



Impact of Arctic sea-ice loss on midlatitude Atlantic ocean circulation

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Annual minimum Arctic sea-ice extent has declined steadily since the 1970s and climate models indicate that the Arctic will be ice free in summer within 30 years. Models and observations strongly suggest that Arctic sea-ice retreat is caused by anthropogenic warming. Climate models suggest future reduction in Arctic sea-ice cover may reduce and ultimately shut down the Atlantic Meridional Overturning Circulation (AMOC) with attendant consequences for European Climate. Here we present analysis of a pair of ocean model simulations where one is forced to have very low Arctic sea ice. The difference between these simulations reveals how signals associated with changes in Arctic sea ice propagate into the North Atlantic and beyond. Low sea ice reduces the AMOC by 5 Sv ($\sim 25\%$), due to changes to the east-west oceanic pressure gradient caused by propagation of barotropic and baroclinic Kelvin and Rossby waves, and oceanic advection. Large ($>2\text{K}$) changes to near surface ocean temperature are observed along the oceanic western boundary currents and along the Mid Atlantic Ridge. We conclude that Arctic sea ice retreat is likely to strongly modify North Atlantic ocean circulation on a variety of timescales with sufficient magnitude to influence regional atmospheric dynamics, weather and climate.