

## On the atmospheric response experiment to a Blue Arctic Ocean

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We demonstrated atmospheric responses to a reduction in Arctic sea ice via simulations in which Arctic sea ice decreased stepwise from the present-day range to an ice-free range. In all cases, the tropospheric response exhibited a negative Arctic Oscillation (AO)-like pattern. An intensification of the climatological planetary-scale wave due to the present-day sea ice reduction on the Atlantic side of the Arctic Ocean induced stratospheric polar vortex weakening and the subsequent negative AO. Conversely, strong Arctic warming due to ice-free conditions across the entire Arctic Ocean induced a weakening of the tropospheric westerlies corresponding to a negative AO without troposphere-stratosphere coupling, for which the planetary-scale wave response to a surface heat source extending to the Pacific side of the Arctic Ocean was responsible. Because the resultant negative AO-like response was accompanied by secondary circulation in the meridional plane, atmospheric heat transport into the Arctic increased, accelerating the Arctic amplification.

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