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Two-way coupling between Barents Sea ice and anomalous Eurasian winters

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With the rapid decline in Arctic sea ice over the last decades, there has been heightened interest in how interactions between the ice cover and the atmosphere contribute to climate variability. Although sea ice decline has been largest in summer, the multiyear ice cover is declining more rapidly in winter, with the most pronounced decreases in the Barents Sea. The decline in Barents Sea ice has been implicated in forcing the "Warm Arctic Cold Siberia" (WACS) pattern via enhanced ocean-to-atmosphere turbulent heat fluxes, but their exact role and the responsible mechanisms are still unclear. Here, we investigate the nature of the link between Barents Sea ice cover and the "Warm Arctic Cold Siberia" pattern by focusing on turbulent heat flux anomalies in the winter season (DJF). We apply empirical orthogonal function and composite analysis to various reanalysis (1979 - 2012) and satellite products. We find reduced ocean-to-atmosphere turbulent heat flux anomalies in association with the WACS pattern and reduced Barents Sea ice cover, a relationship that is inconsistent with the WACS being a direct atmospheric response to sea ice decline. The analyses indicate a substantial atmospheric contribution to observed variability of turbulent heat fluxes and ice cover in the Barents Sea, as well as the expected out-of-phase temperature fluctuations between the Barents Sea and Siberia. Our study highlights the complex, two-way coupling between the atmosphere and Barents Sea surface conditions. The results contribute to understanding the relationship between observed sea ice changes and extreme weather conditions in the mid-latitudes, and suggest that the WACS pattern is likely more complicated than a pure atmospheric response to sea ice loss.