



Recent Cold Winters over Central Eurasia and Arctic Sea Ice Retreat in AGCM Simulations

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The early 21st century was marked by several persistent winter cold spells over Eurasia after a prolonged period of anomalously mild winters during the late 20th century. The negative temperature anomalies were linked to a blocking anti-cyclone centered south of the Barents Sea, which weakened the westerly flow and caused advection of cold Arctic air masses to the continent. The period with an increased occurrence of such cold spells coincided with a strong reduction of winter Arctic sea ice extent which was most pronounced in the Barents Sea, suggesting a possible connection. We performed simulations with the atmospheric general circulation model (AGCM) ECHAM5 forced by multi-year sea ice anomalies observed during the last decades. The regional circulation response to the reduced sea ice extent observed in 2005-2012 exhibits a statistically significant anti-cyclonic surface pressure anomaly, with a surface temperature response similar to that observed. In contrast, Arctic sea ice anomalies during the preceding periods drive different response patterns. The results suggest that the step-like winter sea ice reduction in the Barents Sea in 2005 could have been responsible for the more frequent occurrences of cold winters in Eurasia. Furthermore, a non-linear atmospheric circulation response to the Arctic sea ice reduction during the last 40 years is suggested by the model, where the response depends on the overall sea ice extent.