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Evidence linking Arctic amplification to fewer mid-latitude cold extremes

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In spite of mean climate warming, an ostensibly large number of high-impact cold extremes have occurred in the Northern Hemisphere mid-latitudes over the past decade. One explanation is that Arctic amplification—the greater warming of the Arctic compared with lower latitudes associated with diminishing sea ice and snow cover—is altering the polar jet stream and increasing temperature variability. Here we present evidence to the contrary, that in fact, temperature variability has decreased in the recent past and furthermore, that this decline is robustly projected to continue in the future. Observational evidence suggests that subseasonal cold-season temperature variability has significantly decreased over the mid- to high-latitude Northern Hemisphere in recent decades. This is partly because northerly winds and associated cold days are warming more rapidly than southerly winds and warm days, and so Arctic amplification acts to reduce subseasonal temperature variance. Similar changes are robustly projected by the CMIP5 models in response to increasing greenhouse gas concentrations, in AGCM simulations forced by solely Arctic sea ice loss, and in highly-idealised GCM experiments. Using as an illustrative example, the cold extremes experienced over North America in early January 2014, we show that projected Arctic sea ice loss alone reduces the odds of such an event by one quarter to one third by the mid twenty-first century, and to zero (or near-zero) by the late twenty-first century. Both projected mean warming and a decrease in winter temperature variability contribute to the reduced risk of daily cold extremes.