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Arctic sea ice melt, the Polar vortex, and mid-latitude weather: Are they connected?

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The potential of recent Arctic changes to influence broader hemispheric weather is a difficult and controversial topic with considerable skepticism, as time series of potential linkages are short (<10 years) and the signal-to-noise ratio relative to chaotic weather events is small. A way forward is through further understanding of potential atmospheric dynamic mechanisms. Although not definitive of change in a statistical or in a causality sense, the exceptionally warm Arctic winters since 2007 do contain increased variability according to some climate indices, with six negative (and two positive) Arctic Oscillation atmospheric circulation index events that created meridional flow reaching unusually far north and south. High pressure anomalies developed east of the Ural Mountains in Russia in response to sea-ice loss in the Barents/Kara Seas, which initiated eastward-propagating wave trains of high and low pressure that advected cold air over central and eastern Asia. Increased Greenland blocking and greater geopotential thickness related to low-level temperatures increases led to northerly meridional flow into eastern North America, inducing persistent cold periods. Arctic connections in Europe and western North America are less clear. The quantitative impact of potential Arctic change on mid-latitude weather will not be resolved within the foreseeable future, yet new approaches to high-latitude atmospheric dynamics can contribute to improved extended range forecasts as outlined by the WMO/Polar Prediction Program and other international activities.