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Toward Resolving the Arctic/Midlatitude Weather Linkage Controversy

James Overland (1) and Muyin Wang (2)

(1) NOAA?Pacific Marine Environmental Laboratory, United States (james.e.overland@noaa.gov), (2) JISAO/University of Washington, United States

Given ongoing large changes in the Arctic, high-latitude forcing is a new potential driver for subseasonal weather impacts at midlatitudes in coming decades. Such linkage research, however, is highly controversial. Some metrics find supporting evidence and others report no robust correlations. Model studies reach different conclusions. Case studies from particular historical months suggest potential connections. We propose that a difficulty in resolving the science is due to the inherent complexity and the intermittent character of atmospheric dynamics, which serves as a variable causal bridge between changes in the Arctic and midlatitude weather. Linkages may be more favorable in one atmospheric jet stream pattern than another. Linkages are a two-step process: thermodynamic forcing, i.e. warm Arctic temperatures and loss of sea ice, is generally favorable in the last decade, but internal atmospheric dynamics, i.e. the jet stream location and strength (weak PV gradient), must also allow for a connection. Thus in the last decade only a few linkage events are noted into and out of the Arctic; for example 2006, 2016, and 2018 had warm Arctic Januaries, and 2010 and 2017 had cold December temperatures in eastern North America. Record large sea-ice-free areas and warm temperatures north of Alaska and over Baffin Bay helped to anchor the long wave geopotential height pattern, which in turn feed cold temperatures into the eastern US. Intra-seasonal and inter-annual intermittency explains low direct Arctic/midlatitude linkage correlations and large variability in model studies. Yet a full understanding is necessary for important future forecasts of increased Arctic/midlatitude interactions.