Influence of Atlantic and Pacific multidecadal variability on Arctic warming

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We investigate the influence of Atlantic and Pacific multidecadal variability on the Arctic temperature, with a particular focus on the early 20th century Arctic warming (E20CAW). Arctic surface air temperature increased rapidly over the early 20th century, at rates comparable to those of recent decades despite much weaker greenhouse gas forcing. We find that the concurrent phase shift of Atlantic and Pacific multidecadal variability is the major driver for the rapid E20CAW. Atmospheric model simulations reproduce the E20CAW when forced with an improved sea surface temperature (SST) dataset. The E20CAW is associated with the cold-to-warm phase shifts of Atlantic and Pacific multidecadal variability modes. Atmospheric circulation changes are important for the E20CAW. The extratropical North Atlantic and North Pacific SST warming strengthens surface westerly winds over northern Eurasia, intensifying the warming there. The equatorial Pacific warming deepens the Aleutian low, advecting warm air to the North American Arctic. Coupled ocean-atmosphere simulations support the constructive intensification of Arctic warming by a concurrent, negative-to-positive phase shift of the Pacific and Atlantic multidecadal variability. Our results aid attributing the historical Arctic warming and thereby constrain the amplified warming projected for this important region.

Keywords: Atlantic multidecadal variability, Pacific decadal variability, Arctic warming

