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North Hemispheric winter air temperature variability and its linkage to North Pacific and North Atlantic SST modes?

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Winter surface air temperature (SAT) over North America exhibits pronounced variability on sub-seasonal-to-interdecadal timescales, but its causes are not fully understood. Here observational and reanalysis data from 1950-2017 are analyzed to investigate these causes. Detrended daily SAT data reveals a known warm-west/cold-east (WWCE) dipole over midlatitude North America and a cold-north/warm-south (CNWS) dipole over eastern North America. It is found that while the North Pacific blocking (PB) is important for the WWCE and CNWS dipoles, they also depend on the phase of the North Atlantic Oscillation (NAO). When a negative-phase NAO (NAO-) concurs with PB, the WWCE dipole is enhanced (compared with the PB alone case) and it also leads to a warm north/cold south dipole anomaly in eastern North America; but when PB occurs with a positive-phase NAO (NAO^+), the WWCE dipole weakens and the CNWS dipole is enhanced. In particular, the WWCE dipole is favored by a combination of eastward-displaced PB and NAO^- that form a negative Arctic Oscillation. Furthermore, a WWCE dipole can form over midlatitude North America when PB occurs together with southward-displaced NAO^+.The PB events concurring with NAO^- (NAO^+) and SAT WWCE (CNWS) dipole are favored by the El Nio-like (La Nia-like) SST mode, though related to the North Atlantic warm-cold-warm (cold-warm-cold) SST tripole pattern. It is also found that the North Pacific mode tends to enhance the WWCE SAT dipole through increasing PB-NAO^- events and producing the WWCE SAT dipole component related to the PB-NAO^+ events because the PB and NAO^+ form a more zonal wave train in this case.