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Intraseasonal Variability of the Warm Arctic-Cold Eurasia Pattern and the Associated Atmospheric Circulations

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Based on daily data from ERA-Interim reanalysis, this study examines intraseasonal variability of the warm Arctic-cold Eurasia (WACE) pattern for the extended winter (November through March). Results show that the WACE pattern, which assumes basically a seesaw structure in the air temperature field over the Arctic-Eurasian continent sector, has an e-folding time scale of 6-10 days varying from month to month. At the same time, this study finds that the WACE pattern in different months show apparently different interannual variations while only in December and January the WACE pattern have an upward trend for the withers from 1979/80 to 2015/16.

The results of this study also show that the anomalous atmospheric circulations associated with the WACE patterns vary from month to month. For November and December, the WACE pattern-associated upper-tropospheric height anomalies take the form of wave trains running from the Gulf Stream extension northward across the Arctic into Eurasian continent. Differently, for January, the height anomaly takes the form of dipole structure which is located locally over the Arctic and Asian continent, while for February the height anomaly assumes again the form of wavetrain which is running from the Gulf Stream extension northeastward across Europe then southward into Asian continent. For March, WACE pattern-associated wave train initially arises from the Arctic center of the North Atlantic Oscillation (NAO)-like pattern, which differs the formation processes of the other months. It appears that for all the months from November to March it is the strong warm advection by the southerlies between the Arctic and Eurasian continent anomalous centers of the wavetrains which plays a crucial role in the formation of the Arctic warming and the WACE pattern.

Finally, this study shows that the WACE pattern-associated wavetrains for November and December are significantly modulated by the see surface temperature (SST) anomalies over the Gulf Stream region, while for January and February the WACE-associated wavetrains in height field shows significant correlation with the SST anomalies over central North Pacific and equatorial central and eastern Pacific. This suggests that the SST anomalies over Gulf Stream extension as well as the SST anomalies over the extratropical and equatorial Pacific may contribute to the formation of the wintertime WACE patterns.