

EGU24-3810, updated on 20 May 2024

<https://doi.org/10.5194/egusphere-egu24-3810>

EGU General Assembly 2024

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Subseasonal Modes of Winter Surface Air Temperature in Eurasia's Mid- and High-Latitudes: Contributions from the North Atlantic and Arctic Regions

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A significant and striking seesaw pattern of winter surface air temperature (SAT) has emerged, featuring pronounced warming Arctic and cooling Eurasian (referred to as WACE). This study investigates the subseasonal SAT modes across the mid- and high-latitudes of Eurasia and their possible mechanisms based on daily reanalysis data from 1979 to 2022. Our results reveal that Eurasian winter SAT exhibits two distinct subseasonal modes, characterized by a correlated southeastward propagation of temperature and geopotential height anomalies (GHAs) in the middle and lower troposphere. Notably, 8 phases of the subseasonal SAT modes are identified to form a comprehensive life cycle from the Arctic to East Asia. The sixth phase of the subseasonal SAT modes is proved to be the key transition phase from the WACE pattern to its counterpart. Further analysis indicates that the subseasonal tropospheric potential height anomalies over the Arctic are determined by the anomalies of stratospheric potential height and the surface turbulent heat fluxes anomalies in the north Atlantic.