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Predictable Patterns of Wintertime Surface Air Temperature in Northern Hemisphere and Their Predictability Sources in the SEAS5

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Slow-varying atmospheric boundaries are the main sources of seasonal climate predictions, and their footprints on climate variables may be captured as predictable patterns. Based on 36-yr hindcasts from the fifth-generation seasonal forecast system of the European Centre for Medium-Range Weather Forecasts (SEAS5), the most predictable patterns of the wintertime 2-m air temperature (T2m) in the extratropical Northern Hemisphere are extracted via the maximum signal-to-noise (MSN) empirical orthogonal function (EOF) analysis, and their associated predictability sources are identified. The main findings of this study are as following:

- The MSN EOF1 captures the warming trend that amplifies over the Arctic but misses the associated warm Arctic–cold continent pattern. The MSN EOF2 delineates a wavelike T2m pattern over the Pacific–North America region, which is rooted in the tropical forcing of the eastern Pacific-type El Niño–Southern Oscillation (ENSO). The MSN EOF3 shows a wavelike T2m pattern over the Pacific–North America region, which has an approximately 90° phase difference from that associated with MSN EOF2, and a loading center over midlatitude Eurasia. Its sources of predictability include the central Pacific-type ENSO and Eurasian snow cover. The MSN EOF4 reflects T2m variability surrounding the Tibetan Plateau, which is plausibly linked to the remote forcing of the Arctic sea ice.
- The information on the leading predictable patterns and their sources of predictability is further used to develop a calibration scheme to improve the prediction skill of T2m. The calibrated prediction skill in terms of the anomaly correlation coefficient improves significantly over midlatitude Eurasia in a leave-one-out cross-validation, implying a possible way to improve the wintertime T2m prediction in the SEAS5.