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Why Northeast China Has a Cooling Trend in 21st century?

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Under the global warming scenarios, the air temperatures (T_{2m}) in China in boreal winter shows a remarkable increasing trend since the 1980s, which is quite similar with the change of the globe. But in Northeast China (NEC), the temperature displays an opposite characteristics with an obvious decreasing trend in recent two decades. Results of the empirical orthogonal functions (EOF) of T_{2m} in China indicate that the first leading mode is a consistent positive or negative temperature departures in the whole country, but the variance of this mode show a weakening tendency. The second leading mode of T_{2m} in China shows a seesaw temperature anomaly pattern in NEC and in other regions of eastern China. Different from the 1st EOF mode, variances of this mode show an intensifying tendency. Both statistical analysis and case studies of 20 winters during 2000 to 2019 indicate that this opposite change in NEC may be related to the decadal relationship between the Siberian high and the Arctic oscillation. Previous studies explored that there was a significant negative correlation between the two factors, but this relationship was significantly weakened in the past two decades, which led to the independent influences from the two circulation members on the temperature in NEC, and consequently resulted in an inconsistent variation in the region.