Relative contributions of synoptic and intraseasonal variations to strong cold events over eastern China

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The present study investigates the relative roles of intraseasonal oscillations (ISOs) and synoptic variations in strong cold events over eastern China during the boreal winter. The ISOs and synoptic variations explain about 55% and 20% of the total area-mean temperature anomaly in eastern China, respectively. The advection of synoptic winds on synoptic temperature gradients has a leading contribution to the temperature decrease before the cold events and thus the synoptic variations are important in determining the time of peak cold anomalies. The ISOs have a larger role in sustaining the cold events. The height anomalies associated with ISOs and synoptic variations are manifested as Rossby wave trains propagating along the polar front jet over the Eurasian continent before the cold events. They both contribute to the deepening of the East Asian trough and the development of cold events. Compared to the ISO wave train, the synoptic wave train has a smaller spatial scale and moves faster. There are obvious intraseasonal signals in the stratosphere about one week before the cold events over eastern China. Large negative height anomalies associated with the weakening of the polar vortex are observed over the North Atlantic. These anomalies move eastwards and propagate downwards after reaching the west coast of Europe. The downward moving stratospheric signal triggers height anomalies in the troposphere over the entrance region of the polar front jet. Then the anomalies propagate towards East Asia along the wave train, contributing to the intensification of the Siberian high and the East Asian trough and the occurrence of cold events over eastern China.