Two Distinct Types of Extratropical Circulation Anomalies Associated with Cold Surges over the South China Sea

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This study investigated the extratropical circulation anomalies responsible for cold surges over the South China Sea in winter. The surge events were identified by the intensity of northerly winds over 110–117.5° E along 15° N at 925 hPa. Two distinct patterns of sea-level pressure (SLP) anomalies in East Asia were found to have a crucial role in inducing cold surges over the South China Sea. Accordingly, the cold surge events were classified into two types. The first type of cold surge is characterized by a pair of SLP anomalies with positive and negative ones centered over China and Japan, respectively, whereas the second type of cold surge is characterized by widespread and persistent positive SLP anomalies over East Asia. Furthermore, the first type of cold surge is accompanied by a deepened East Asian Trough and precursory Rossby wave trains across the Eurasian continent in the mid- and upper troposphere, but the latter is not.

Prior to both the types of the cold surges, the Siberian High is significantly intensified. However, diagnose on SLP tendency indicates that the intensification is related to different physical processes. In the first type of cold surge, the Rossby wave trains favor negative vorticity advection and cold advection, inducing intensification of the Siberian High. By contrast, in the second type of cold surge, vorticity advection can be ignored due to the lack of Rossby wave trains, and only the lower-tropospheric cold advection induced by anomalous northerly winds, which are resulted from the anomalous Siberian High, contributes to the further intensification of the Siberian High.

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