



Different Types of Cold Vortex Circulations over Northeast China and Their Weather Impacts

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A deep and cold vortex circulation often occurs over the Northeast China. Known as Northeast China cold vortex (NCCV), the phenomenon is most active from May to mid-June and can lead to extremely cold local temperatures. This study used rotated principle component analysis to categorize NCCV events into four types, which were characterized by ridges (or blocks) over Lake Baikal (BKL), the Yenisei River valley (YNS), the Ural Mountains (UR) and the Yakutsk/Okhotsk region (YO), respectively.

On the intra-seasonal time scale, it was found that BKL- and YNS-type NCCVs formed when the wave-train height anomalies originating from North Atlantic and Europe propagated to East Asia. In contrast, YO- and UR-type NCCVs formed in conjunction with the development of a meridional dipole pattern over Northeast Asia. The existence of a blocking-type circulation over the Yakutsk/Okhotsk region favored maintenance of the NCCV circulation for the long-lived (more than five days) NCCV events of the four types. The typical circulation over Northeast Asia for the long-lived NCCV event was closely associated with wave breaking, whereas the short-lived (three to five days) event showed only wave propagation.

The YNS-type NCCV caused cold surface air temperatures (SAT) not only over Northeast China but also over Central and South China, whereas the other three types led only to regional cold SAT anomalies over Northeast China. All four types of NCCVs caused a precipitation increase over Northeast China, and this effect was broader for the UR- and YO-type NCCVs than that for BKL- and YNS-type NCCVs.