

Variability of the Siberian high and the East Asian winter monsoon

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The Siberian high is a cold, semi-permanent surface anticyclone residing over the Asian continent in winter. The high is known as one of the crucial factors for wintertime climatic condition over the Far East and Northwestern Pacific, as it influences the strength of the East Asian winter monsoon. However, our understanding is rather limited with respect particularly to the mechanism of how the surface cold high develops under the influence of

circulation anomalies in the upper troposphere. In this study, time evolution and dynamical mechanism of intraseasonal amplification of the high are investigated on the basis of the circulation data observed over the recent 40 years.

For each grid point over Siberia, a composite analysis was performed for the 20 strongest anticyclonic events separately. At every location, a surface cold high was found to amplify in association with formation of a blocking ridge in the upper troposphere. The evolution of the upper-level blocking was found quite different between the east and west of the climatological upper-level trough over the Far East. To the west, what may be called wave-train type is common, in which a blocking ridge forms near the leading edge of a quasi-stationary Rossby wavetrain propagating eastward across the Eurasian continent. To the east of the trough, in contrast, what may be called Pacific-origin type dominates, in which a blocking ridge forms in association with a westward extension of anticyclonic anomalies from the North Pacific.

Interaction mechanisms between the upper-level and surface anomalies were important in amplification of a surface cold high of the both type.

Extreme cold-air outbreaks to Japan were observed in the 2005/06 winter. The typical Pacific-origin type was found in the middle of November 2005 when the first cold-air outbreak attacked mid-latitude Far East, while the wave-train type was observed in the middle of December when the anomalously cold air reached its peak. Thus, these two types can be considered as basic patterns which bring variability of the East Asian winter monsoon.