

Isentropic Analysis of Polar Cold Air Mass Streams in the Northern Hemispheric Winter Monsoon

Toshiki IWASAKI¹, Yuki KANNO¹ and Takamichi SHOJI¹

¹ *Graduate School of Science, Tohoku University, Sendai, Japan*

1. Mass-weighted isentropic zonal mean (MIM) cold air streams

A diagnostic method is presented of polar cold air mass streams defined below a potential temperature. In NH winter, MIM's mass stream functions have a distinct extratropical direct (ETD) circulation with a maxima around (280K, 45N), indicating that $\theta=280\text{K}$ is appropriate to the threshold of polar cold air mass. The high-latitude downward motion indicates the diabatic generation of cold air mass, whereas the mid-latitude equatorward flow does its outbreak. The strength of equatorward flow is under control of wave-mean flow interactions (Iwasaki and Mochizuki, 2012).

2. Geographical distribution of the cold air mass stream in the NH winter

In the NH winter, the polar cold air mass flux has two distinct mainstreams, i.e., East Asian (EA) stream and North American (NA) stream (Iwasaki et al., 2014). The former grows over the northern Eurasian continent, turns toward East Asia and disappears over the western North Pacific Ocean. The latter grows over the Arctic Ocean, flows toward the East Coast of North America and disappears over the western North Atlantic Ocean. These match with main routes of cold surges which bring severe cold waves over East Asia and eastern North America (Shoji et al, 2014)..

A two box model composed of residence time in the genesis box and life time in the loss box is proposed (Kanno et al., 2015). We compare the cold air mass amounts between the two hemispheric winters, and validity of charge-discharge model, based on the two box model.

Key words: isentropic analysis, cold air outbreak

References

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