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1. Introduction
A diagnostic method is presented of polar cold air mass streams defined below a threshold potential temperature. The isentropic threshold facilitates a Lagrangian view of the cold air mass streams from diabatic generation to disappearance.

2. Mass-weighted isentropic zonal mean (MIM) cold air streams
In winter hemispheres, MIM's mass stream functions show a distinct extratropical direct (ETD) cell in addition to the Hadley cell. The mass stream functions have local maxima at around (280K, 45N) for NH winter and, around (280K, 50S) for SH winter. Thus, =280K may be appropriate to a threshold of the polar cold air mass for both hemispheres. 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 significant control of wave-mean flow interactions.

3. Geographical distribution of the cold air mass streams in the NH winter
In the NH winter, the polar cold air mass flux has two distinct mainstreams, hereafter called as East Asian (EA) stream and the North American (NA) stream. The former grows over the northern part of the Eurasian continent, turns down southeastward 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 coincide well with main routes of cold surges.

4. Comparison between NH and SH winter streams
The cold air mass streams in NH winter are more asymmetric than those in SH winter. The NH total cold air mass below =280K is about 1.5 times greater than the SH one. These come mainly from the topography and land-sea distribution. The mid-latitude mountains steer the cold air mass streams on the northern sides and enhance the residence time over its genesis region.