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Title: Variability of Mass Transport into Polar Stratosphere and Winter Cold Air Outbreaks in Mid-latitudes

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Abstract:

We have developed indices measuring the total poleward mass transport into the polar stratosphere and total equatorward air mass transport out of the polar troposphere on daily basis using NCEP-NCAR reanalysis for the period of 1979-2011. These two indices are positively correlated, implying that a stronger poleward mass circulation in the polar stratosphere above tends to be compensated by a stronger equatorward mass transport by the cold air branch below and vice versa. We have also developed various indices that measure the continental-scale warmness and coldness in high latitudes and mid-latitudes. It is shown that a lack of warm air into polar stratosphere is accompanied by weaker equatorward advancement of cold air near the surface. As a result, the cold air mass is largely imprisoned within polar circle, responsible for general warmness in mid-latitudes and below climatology temperature in high latitudes. Conversely, a stronger warm air transport into polar stratosphere is accompanied by a stronger equatorward advancement of cold air near the surface, resulting in massive cold air outbreaks in mid-latitudes and warmth in high latitudes.

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