Geophysical Research Abstracts
Vol. 19, EGU2017-12425, 2017
EGU General Assembly 2017

Interannual variability of the North American cold air stream and associated atmospheric circulations

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In boreal winter, cold air mass (CAM) flux below a designated potential temperature of 280 K forms a distinct climatological mean cold air stream in North America (NA). This study investigates interannual variability of the NA cold air stream and associated atmospheric circulations for January during 1959-2016. Empirical Orthogonal Function (EOF) analysis of the meridional CAM flux across 60°N between the Rocky Mountains and Greenland clarifies two leading variation modes of the NA stream, and associated atmospheric circulations are characterized by composites for the corresponding principal components (PCs).
The first EOF mode shows a zonal dipole with the center at 80°W. The positive PC1 winters are characterized by strong NA stream at its climatological mean position, cold anomalies over the entire part of NA except for Alaska, positive Tropical Northern Hemisphere pattern, and displacement or split of a stratospheric polar vortex.
The second EOF mode shows a zonal dipole with the center at 105°W. The positive (negative) PC2 winters are characterized by positive (negative) phase of the Arctic Oscillation and North Atlantic Oscillation, eastward (westward) sift of the NA stream, more (less) drain of CAM in NA, and strong (weak) stratospheric polar vortex. The positive PC2 winters accompany a cold anomaly over the eastern part of Canada. On the other hands, the negative PC2 winters occur with a cold anomaly elongates from western Canada to Midwest of United States. These results suggest that the route of the NA stream affects to a winter climate in NA.