Identification of a Multi-Decadal Teleconnection Pattern in the Extratropical Northern Hemisphere

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ABSTRACT

A multi-decadal teleconnection pattern of geopotential height in the upper troposphere of the extratropical Northern Hemisphere is identified in this study. The pattern is characterized by a zonal band of geopotential height between 35°N and 65°N, which extends from the North Atlantic to the west coast of North America. The anomaly is positive before 1967 and after 1986, and negative in between. The existence of this pattern results in the multi-decadal fluctuation of zonally-averaged geopotential height in the extratropical Northern Hemisphere and the Eurasian jet stream. This pattern is independent from the global warming mode, but is in phase with the large warming trend since late 1980's. The pattern exhibits an equivalent barotropic vertical structure with the largest amplitude in the upper troposphere, and is closely associated with the multi-decadal fluctuation of surface temperature in the Eurasian continent. While most evident in annual mean, the pattern is also clearly observed during most time of the year. Although extending over the whole Eurasian continent, this pattern exhibits larger amplitudes over the major mountain ranges in the region. Interestingly, this pattern fluctuates coincidentally with the Atlantic Multi-decadal Oscillation and the Northern Hemisphere mean surface temperature since the mid 20 Century. The relationship between this pattern and the AMO and the hemispheric-scale temperature fluctuation will be further explored.