

# **Multidecadal fluctuation of the wintertime Arctic Oscillation pattern and its implication**

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The multidecadal fluctuations in the patterns and teleconnections of the winter mean Arctic Oscillation (AO) are investigated based on observational and reanalysis datasets. Results show that the Atlantic center of the AO pattern remains unchanged throughout the period 1920–2010, whereas the Pacific center of the AO is strong during 1920–1959 and 1986–2010 and weak during 1960–1985. Consequently, the link between the AO and the surface air temperature over the western North America is strong during 1920–1959 and 1986–2010 and weak during 1960–1985. The time-varying Pacific center of the AO motivates a revisit to the nature of the AO from perspective of decadal change. It reveals that the North Pacific Mode (NPM) and North Atlantic Oscillation (NAO) are the inherent regional atmospheric modes over the North Pacific and North Atlantic, respectively. Their patterns over the North Pacific and North Atlantic remain stable and change little with time during 1920–2010. The Atlantic center of the AO always resembles the NAO over the North Atlantic, but the Pacific center of the AO only resembles the NPM over the North Pacific when the NPM–NAO coupling is strong. These results suggest that the AO seems to be fundamentally rooted in the variability over the North Atlantic, and that the annular structure of the AO very likely arises from the coupling of the atmospheric modes between the North Pacific and North Atlantic.

Key words: Arctic Oscillation, North Atlantic Oscillation, North Pacific Mode, Multidecadal Variations