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Energetics of the Northern Hemisphere Storm Tracks in Strong AO Anomaly Winters

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The Northern Hemisphere winter 300hPa storm tracks/baroclinic waves and their energetics during the strong Arctic Oscillation (AO) anomaly events are investigated by use of NCEP\NCAR reanalysis data. It is shown that during strong positive AO anomaly winters(SPAOAW) versus strong negative AO anomaly winters(SNAOAW) the Atlantic storm track intensifies significantly and shifts northward and far downstream while the Pacific storm track extends westward. The baroclinic waves over the Atlantic propagate along the central North Atlantic during the strong negative AO anomaly winters while during the strong positive AO anomaly winters, the waves over the Atlantic split into two branches: the northern branch passes along the northern Atlantic and the southern branch runs south-eastward into the tropic.

The distributions of the kinetic energy and energy conversions over the storm track regions assume different characteristics for different AO phases. The impact of spatial scale on the variation of energy and energy conversion is examined. It is shown that (a) The synoptic waves are more active over the central Northern Pacific, North Atlantic and Europe during the SPAOAW than the SNAOAW while the planetary waves are more active over the northeastern Pacific, northeast Atlantic and Europe. (b) The baroclinic conversion peak over the Atlantic intensifies and shifts northward and downstream during the SPAOAW versus the SNAOAW, the wave-wave interaction process is responsible for this change. From the SNOAW to the SPAOAW the baroclinic conversion peak over the Pacific contracts toward the central Northern Pacific, and a decrease in the conversion due to the planetary wave term is responsible for the change. (c) As to the barotropic conversion, the positive conversion center over

America weakens considerably and the negative conversion center deepens significantly during the SPAOAW than the SNAOAW but barotropic conversion over Pacific remains almost unchanged. The synoptic waves dominate the barotropic conversion and the wave-wave interaction term is negligible.