

The Relationship Between Arctic Oscillation and Intense Cyclone Patterns and their Impacts on Summer Precipitation Distribution in the Canadian Arctic

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ABSTRACT

A trend analysis of the Arctic System Reanalysis Version 2 (ASRv2) data from 2000 to 2015 showed that changes occurring with summer rainfall and snowfall are synchronized in the Canadian Arctic, rather than changing between forms. The precipitation in July showed a significant decreasing trend between 75° N and 80° N, while a significant increasing trend was found in September between 70° N and 80° N. Comparing the precipitation distribution in the Canadian Arctic with low-pressure system (center pressure < 1000 hpa) frequency and intensity patterns in the same study period showed high consistency, while the strength of the Arctic Oscillation (AO) also showed varying degrees of correlation with the frequency and intensity of the cyclones in the study area, thus affecting the distribution of precipitation. Visualizing the wind speed reanalysis data for each summer month showed that the distribution of intense cyclones is related to the positive or negative AO. The negative AO index in July in the 16 years corresponds to a southern movement of the jet stream, thus higher intensity cyclones, with local Laplacian over 15 mPa km⁻², are mostly observed in the areas around 60° N and further south, resulting in less precipitation in the northern high latitudes. On the contrary, the positive AO index in September corresponds to the northward shift in the jet stream, and more intense cyclones are observed between 70° N and 80° N, which brought more precipitation to the high latitude area in Canadian Arctic in the summertime. Meanwhile, strong positive AO index months are found to have more snow than negative AO index months in the higher latitudes. Finally, along the eastern coast of the Canadian Arctic, higher snow amounts, corresponding with more intense cyclones, are often found in positive AO index months, while this pattern is not evident for rain.

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