Wavelet Analysis of Precipitation Extremes Over Canadian Ecoregions and Teleconnections to Large-Scale Climate Anomalies

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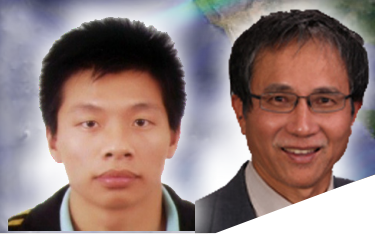

Research Summary

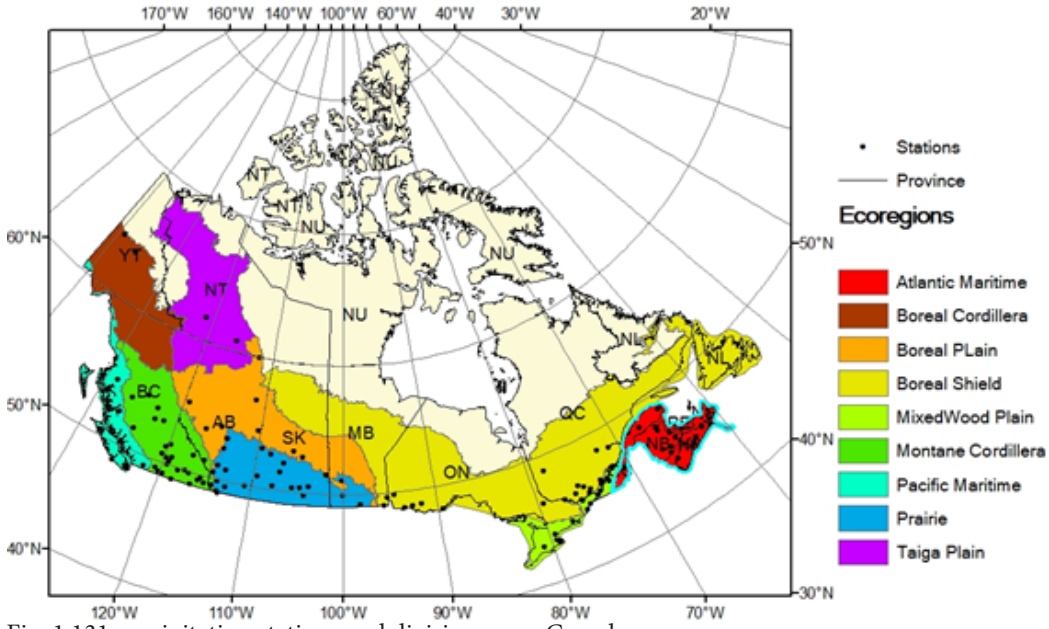

Fig. 1 131 precipitation stations and divisions over Canada

To detect significant interannual and interdecadal oscillations and their teleconnections to large-scale climate anomalies such as El Niño Southern Oscillation (ENSO), Pacific Decadal Oscillation (PDO) and the North Atlantic Oscillation (NAO), monthly and seasonal maximum daily precipitation (MMDP and SMDP) from 131 stations across Canada were analyzed using variants of wavelet analysis. Interannual (1-8 years) oscillations were found to be more significant than interdecadal (8-30 years) oscillations for all selected stations, and the oscillations are both spatial and time-dependent. Similarly, the significant wavelet coherence and the phase difference between leading principal components (PCs) of monthly precipitation extremes and climate indices were highly variable in time and in periodicity, and a single climate index explains less than 40% of the total variability. Partial wavelet coherence analysis shows that both ENSO and PDO modulated the interannual variability, and PDO modulated the interdecadal variability, of MMDP over Canada.

NAO is correlated with the western MMDP at interdecadal, and the eastern MMDP at interannual scales. Composite analysis shows that precipitation extremes at about 3/4 of the stations have been significantly influenced by ENSO and PDO patterns, while about 1/2 of the stations by the NAO patterns. The magnitude of SMDP in extreme El Niño years, and extreme PDO event of positive phase, was mostly lower (higher) over the CP region in summer and winter (spring and autumn) than in extreme La Niña years. Overall, the degree of influence of large-scale climate patterns on Canadian precipitation extremes varies by season and by region.

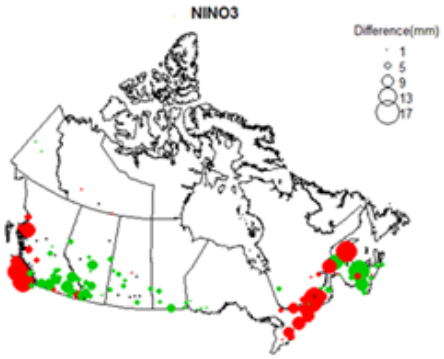

Fig. 2 Composite differences in winter maximum daily precipitation (WMDP) averaged over 5 years with the lowest and the highest NINO3 values, respectively. Red and green dots indicate stations whose WMDP is statistically significantly influenced by NINO3 positively and negatively, respectively

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