



An Assessment of Summer Hydro-Climatic Variability and Extremes on the Canadian Prairies

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Within Canada, the Canadian Prairies are a region of high natural hydro-climatic variability with the periodic occurrence of severe droughts and excess moisture conditions that often have severe impacts on the environment and economy. Although previous studies examined the occurrence and atmospheric causes of Canadian Prairie droughts during the instrumental period, none have focused on the spatial characteristics of both extreme dry and wet periods. Using the Standardized Precipitation Evapotranspiration Index (SPEI) as a hydro-climatic extreme indicator and an atmospheric synoptic typing procedure, this investigation evaluates the dominant mid-tropospheric atmospheric circulation patterns associated with the spatial characteristics of extreme dry and excessive wet conditions over the southern Canadian Prairies from 1950 to 2011. Results reveal the prevalence of three distinct summer moisture patterns over the study area including same sign anomalies centred over the entire region, and an east-west and north-south dipole pattern. Examination of the daily 500 hPa circulation during summers associated with extremes in these three patterns shows significant increases/decreases in the frequency of key synoptic types in which the locations of mid-tropospheric ridges/troughs and zonal flow impact surface temperature and precipitation. In addition, trends in these key types indicate an increased occurrence of atmospheric circulation patterns associated with both extreme dry and excessive wet summers. Results from this investigation aid in the better understanding of the atmospheric causes associated with the temporal and spatial features of hydro-climatic extremes on the Canadian Prairies. They can also be used to anticipate future changes to these extremes that will benefit society in its ability to anticipate and adapt to future occurrences of these events.