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A Precipitation Dipole and its Seasonality in Eastern North America

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We have identified a dipole in annual precipitation across Eastern North America (ENA) east of 100W between 30N and 60N. This dipole appears to create spatially coherent opposing variations in precipitation with a physical separation of the two regions around 45N. Annual average precipitation over ENA appears to be stable and unimodal, suggesting that the amount of overall precipitation variability is a small fraction of the mean and is largely determined by similar large scale processes. Analysis of regional average time series at inter-annual (3-7 year) and decadal (10-14 year) scales indicates that the dipole over the ENA region is most clearly discernible at the decadal scale. The out-of-phase variations in precipitation between the central United States and eastern Canada are observed in annual precipitation total, but are particularly pronounced in fall (defined as October, November and December) total precipitation. To delineate the structure of the precipitation variations and relate them to the large-scale circulation, we have performed regression analysis with meridional and zonal wind fields, geopotential heights, sea surface temperature, and stream flow. The opposing fall precipitation signals in the two regions are linked through an anomalous circulation regime that stretches from the east coast of Asia to the North Atlantic. The correlation between precipitation in the two regions and the 500mb geopotential height and 850mb meridional wind fields clearly demonstrates the connection between a large-scale wave train originating over the Pacific and enhanced (reduced) transport of moisture into the central US (eastern Canada). The correlation between seasonal precipitation and 850mb meridional winds suggests that southerly winds and enhanced moisture transport from the Gulf of Mexico into the central United States tend to occur

with northerly winds and decreased moisture transport over eastern Canada.