

Storm Tracks Across Eastern Canada

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The global storm tracks patterns across the Northern Hemisphere are well documented, but their regional impact on populations has yet to be characterized, as very few studies took a local perspective on storm tracks. In this study, a Lagrangian tracking algorithm is applied to the 850 hPa relative vorticity field to characterize extratropical storm tracks that pass through major cities in Canada. Storm tracks are first classified in reference to the metropolitan cities that they impact, such as Toronto, Montreal, Halifax and St-John's. They are then subjected to several analyses, including but not limited to the identification of main development regions, typical tracks, mean growth rate intensity and typical regions of decay.

We found that the preferential development regions are the lee of the Rockies, the Great Lakes and the Western Atlantic. The collection of storm tracks across each city is composed of storms developing not from a single development region, but from several. Results show that the storm track variability at a city is dominated by the storm track variability of its predominant development region. Among others, we found that the ensembles of storms crossing East coast cities (Halifax, St-John's) are dominated by Atlantic storms that are more frequent during the winter. Storms passing through Montreal and Toronto travel primarily from the Great Lakes and the mid-latitude Rockies. In eastern Canada, storms from the southernmost part of the Rockies are much less frequent, but this development region is the main source of extreme storms, and thus is important in terms of impacts on metropolitan areas.

The relationship between storm tracks and modes of atmospheric variability are also examined with an emphasis on the El Nino Southern Oscillation (ENSO), North Atlantic Oscillation (NAO) and Pacific North American pattern (PNA). We found that storm frequencies are decreases during negative NAO and PNA regimes, and are more intense during La Nina months. Further, we found that teleconnection shifts storm tracks differently in different regions. The anomalous storm track densities are presented as well as their direct impact on specific metropolitan areas. Results show that the combination of these shifts impact cities differently according to their geographic location.