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Extratropical Transitions in Atlantic Canada: Impacts and Adaptive Responses

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Cyclones originating over the tropical Atlantic may undergo the process of extratropical transition as they move northeastward along the coast of North America. Interaction with eastward-moving mid-latitude cyclones or frontal systems can result in the formation of spatially larger, more powerful storms, marked by frontal characteristics, changes (either increases or decreases) in wind speed and track velocity, and less predictable tracks coupled with increased precipitation and potential for storm surge. Of the 330 tropical cyclones formed over the North Atlantic from 1991 to 2011, 134 (40.6%) underwent partial or total extratropical transition.

The dynamics and threats of extratropical transitions have not been extensively studied. Consequently, forecasters refer to approaching storms as "hurricanes," although they are frequently extratropical in character by the time they reach New York and New England, and almost always have undergone partial or complete transition before making landfall in Atlantic Canada. In rare instances, extratropical transitions may continue to progress eastwards across the North Atlantic. In a typical summer-autumn, Atlantic Canada is impacted by 5 to 7 storms of tropical origin. Due to variations in track and interaction to form extratropical transitions, the number of summer and early autumn storm events in Atlantic Canada is not linked to the total number of hurricanes in any specific year. Overall tropical cyclone frequency in the North Atlantic cannot be directly correlated with temperature variations, or with the frequency or magnitude of summer and early autumn storms in Atlantic Canada.

Extratropical transition "Igor" directly impacted more than 40,000 km2 of eastern Newfoundland on 20-22 September 2010. Current estimates of damage to human property exceed $165 million, and one human life was lost. River flooding resulted from rainfall in excess of 150 mm/24 h in several locations, with peak stream flow locally exceeding 600 m3/s. Storm surge damage occurred along the north shore of the Bonavista Peninsula. Similar effects, differing only in the size of the affected areas, have resulted from several extratropical transitions which have impacted Atlantic Canada since July 1989.

Extratropical transition "Leslie" impacted Newfoundland on 10-11 September 2012. Although the area affected was comparable to "Igor", wind velocities and rainfall totals were less, fortunately limiting damage. Preparation, advance warning to the population, proaction, and response efforts all showed significant improvement, however, indicating that the experience gained from coping with "Igor" had been successfully applied in adaptation to "Leslie".

Extratropical transitions pose a significantly different set of challenges for adaptation in comparison to purely tropical hurricanes, and responses and adaptation strategies should be tailored to address these specific events. Calculating the frequency, magnitude and intensity of potential shifts is important for accurate forecasting and public awareness, safety management, preparedness, and adaptation. Available data indicate an increase in extratropical frequency and severity in Atlantic Canada since 1991, but there are difficulties in establishing the extent and nature of transition for previous storm events. A cautionary policy would assume no significant changes in extratropical transition frequency for Atlantic Canada, but would also acknowledge that large events remain probable.