The impacts of coastal storms on the north shore of Prince Edward Island

G.K. Manson[1], D.L. Forbes[1], G.S. Parkes[2], L.A. Ketch[2], and S.M. Solomon[1]

1. Geological Survey of Canada (Atlantic), P.O. Box 1006, Dartmouth, NS B2Y 4A2, Canada ¶ 2. Meteorological Service of Canada, 45 Alderney Drive, Dartmouth, NS B2Y 2N6, Canada

Long-term sea-level rise off the north shore of Prince Edward Island (PEI) has averaged 0.3 m/century over the past 6000 years and analysis of tide gauge records for Charlottetown and North Rustico, PEI, indicate mean relative sea-level rise of 0.32 m/century since 1911. This rate is projected to increase to 0.7 ± 0.4 m/century over the coming 100 years.

In response to sea-level rise, coastal retreat has averaged >50 m/century over 6000 years, resulting in the submergence of fluvial channels and estuarine and coastal facies. Sand is transported landward to multidecadal to century-scale storage in coastal dune and flood-tidal delta sinks leaving the shoreface, nearshore multiple bar complex, and beaches sand-limited.

Storms supply the energy required for driving coastal retreat and individual large storms can cause local rapid erosion. We document the impacts of two recent severe storms affecting the North Shore of PEI in October 2000 and November 2001 and consider these in context with a catalogue of potentially damaging storms developed using a 90 year record of storm surge occurrences, a 48 year record of wind speeds and directions, a 42 year wave hindcast, and sea-ice charts for 28 winters.

Photogrammetric rectification of digital aerial photography (1935–1990) and shore-zone surveys (1989–2001) show large spatial and temporal variance in coastal recession rates which is partly a function of backshore materials. Retreat of till/sandstone cliffs at <1 m/yr shows no statistically significant decadal variance whereas other sites with dunes have variably retreated up to 3 m/yr and accreted up to 4 m/yr.

Multidecadal healing of former washover and inlet channels in the early airphoto record may reflect recovery from widespread washover predating the 1935 photography that was possibly initiated by intense storms or a succession of storms in the late 19th century. Several sites show local acceleration after 1980 and again after 2000 in response to storms. In general, however, temporal variance in retreat rates is poorly correlated with the storm record. This may be partly due to variable sediment supply altering the morphodynamic response of shorelines to storms, suppression of storm waves by sea ice, and may also reflect the importance of storm clustering on scales of weeks to years in determining erosion vulnerability. The projected increase in the rate of sea-level rise and decrease in ice cover in the southern Gulf imply a potentially significant increase in the coastal erosion hazard on the north shore of PEI.