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Extreme Storm Surges in the Northwest Atlantic: Hindcasts Over the Last 40 Years and Projections for the Next Century.

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Concern over increased coastal erosion and flooding under plausible climate change scenarios motivates this study of sea-level variations along the east coast of Canada and the northeast United States. We report here on results from a 40 year hindcast of storm surges for the Northwest Atlantic using a 2-D barotropic ocean model. We then use these results to generate spatial maps of the return period of extreme sea-levels under current conditions and following global sea-level rise scenarios for the next century.

To generate the maps high resolution (60 km) surface wind and pressure fields are used to drive the storm surge model (38N-60N,42W-72W) and produce hourly fields of sea-level for 1960-1999. We first verify that the return period of observed residuals (observed sea-levels minus tides) at selected gauges agree with the return period of our model hindcasts. Spatial maps of the return period of residual sea-levels for the northwest Atlantic are presented.

Total water levels are reconstructed using the surge hindcasts, tidal predictions, and a novel statistical parameterization that represents baroclinic and seiche effects. The method is shown to work by comparing the return period based on observed annual maxima against the return period calculated from the total sea-level hindcasts. Our approach allows us to calculate flooding risk at locations for which there are little or no data. Finally, the extremal analysis is modified to include the effects of sea-level rise and changes in the frequency and intensity of atmospheric storms. Spatial maps of the return period of extreme sea-levels are presented for the next century.