

Rising sea levels are making Canadian coasts more vulnerable to flooding and erosion.

Rising sea levels threaten familiar shoreline environments. Coastal wetlands, which are important ecosystems and barriers against shoreline erosion, gradually disappear. Bluffs and beaches are more exposed to erosion by waves, groundwater is more likely to become contaminated by salt water, and low-lying coastal areas may be permanently lost. In addition, wharves, buildings, roads, and other valuable seaside property face a greater risk of damage as a result of flooding from storms.

Although global sea levels have been rising since the last ice age, a changing climate is causing them to rise faster. That's mainly because a warmer climate causes sea water to expand as it warms, but water from melting glaciers and polar ice caps is also contributing to the rise. Over the past century, these factors have raised the average level of the world's oceans by between 10 and 20 cm.

Local movements of the land as it adjusts to post-ice age changes can affect sea level too. Along coasts where the Earth's crust is rising, sea levels will increase more slowly or may even fall. Where the Earth's crust is sinking, sea level rise will be greater. As a result, changes in sea level can vary considerably from place to place.

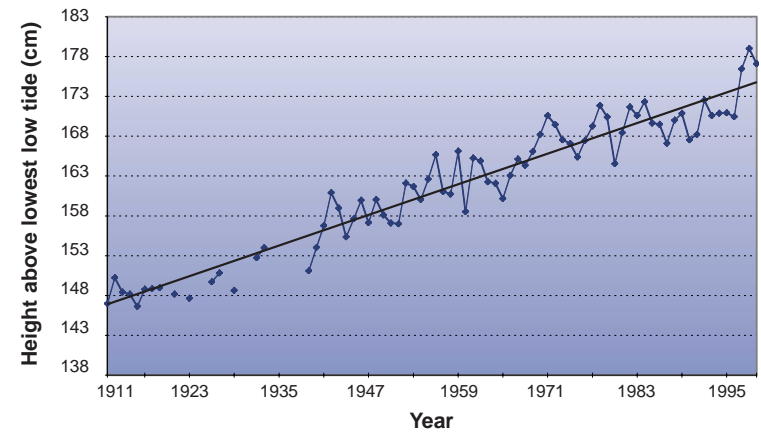
FOCUS: Charlottetown, P.E.I.

Charlottetown is seriously threatened by rising sea levels. Much of its historic core lies just a few metres above the sea, and over the past century the city's average sea level has risen by nearly 30 cm. About 20 cm of that increase is probably the result of local sinking of the land after the last ice age. The rest can be linked to global sea level changes resulting from a warmer climate.

Charlottetown is not about to disappear permanently under the ocean, but higher sea levels are increasing its exposure to severe flooding from storm surges. Storm surges are caused by low air pressure and onshore winds and can temporarily raise the local water level a metre or more above normal. When a large storm surge occurs at the same time as very high tides, extensive flooding occurs.

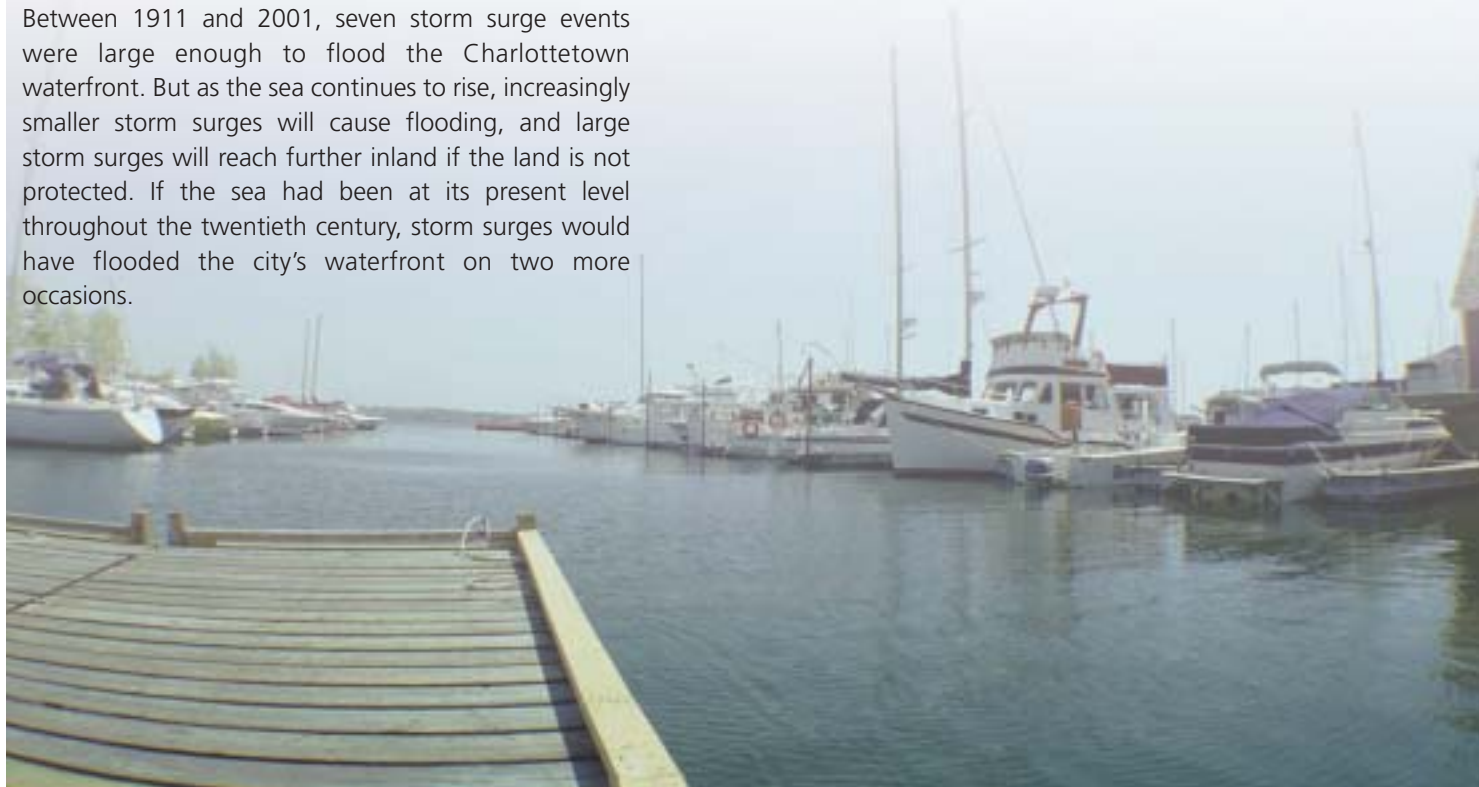
Between 1911 and 2001, seven storm surge events were large enough to flood the Charlottetown waterfront. But as the sea continues to rise, increasingly smaller storm surges will cause flooding, and large storm surges will reach further inland if the land is not protected. If the sea had been at its present level throughout the twentieth century, storm surges would have flooded the city's waterfront on two more occasions.

Charlottetown Annual Mean Sea Level



Source: Adapted from Parkes et al., 2002

The annual sea level at Charlottetown between 1911 and 1998 is shown here in centimetres above the lowest expected low tide level. As well as contributing to long-term increases in sea level, climate also contributes to seasonal and year-to-year variations.



THE BIGGER PICTURE

With the longest coastline in the world, Canada is threatened on several fronts by rising sea levels. However, the possible impacts vary considerably from one place to another. In Atlantic Canada, coastal areas face the possibility of more frequent storm-induced flooding and greater rates of erosion. In Quebec, there is a growing risk that seaside roads along the North Shore of the Gulf of St. Lawrence, on the Gaspé Peninsula, and on the Îles-de-la-Madeleine will be damaged by coastal erosion and landslides.

Another highly vulnerable area is the Beaufort Sea coast – one of the few parts of the Arctic where sea levels

appear to be rising. Coastal erosion there is made worse by the melting of sea and ground ice and is already causing the loss of town waterfront and structures in places such as Tuktoyaktuk.

In B.C. much of the coast is too steep and rocky to be seriously affected by sea level rise. Nevertheless, Prince

Rupert, the highly urbanized Fraser Delta, and many low-lying areas of ecological and archaeological interest on Vancouver Island, the Queen Charlottes, and the Gulf Islands face a growing risk of flooding and erosion as a result of higher sea levels.

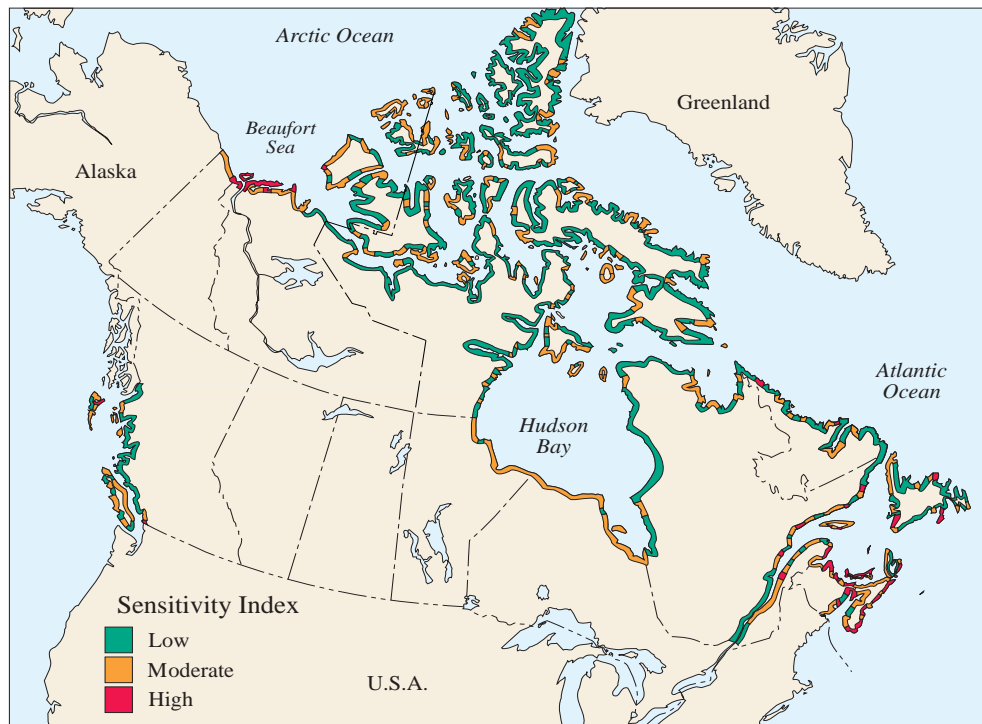
THE GREAT STORM SURGE OF JANUARY 21, 2000

The storm rolled in from the Carolinas, walloping Atlantic Canada with up to 54 cm of snow and a 1.4-metre storm surge that reached parts of the Canadian coast just as unusually high tides were

nearing their peak. The maximum water level exceeded the previous record by almost 40 cm in Charlottetown and even more along parts of the New Brunswick coast. As the storm passed through, massive chunks of ice piled up against the shore and the sea rushed in, flooding streets and buildings.

In Charlottetown, ice damaged wharves and knocked a lighthouse off its foundations. Much of the downtown core was flooded, power supplies were threatened, and city workers made makeshift dikes out of snow to hold back the incoming water. At the city's largest hotel, floodwaters came within metres of the underground parking garage.

Buildings were flooded and several people had to be evacuated from homes in seaside communities around P.E.I. and across the Northumberland Strait in New Brunswick and Nova Scotia. In Shediac, New Brunswick, boats and a backhoe were pressed into service to rescue stranded residents. At Malagash Point, Nova Scotia, two cottages were lifted off their foundations and carried several hundred metres down the beach. The storm also brought severe damage to the island of Newfoundland. High waves battered homes in Port aux Basques, while in Lamaline, on the Burin Peninsula, several houses were flooded and a breakwater was destroyed. Residents described it as the worst flooding to hit the village since the tidal wave of 1929. Miraculously, no lives were lost, but the storm left millions of dollars of damage in its wake.



Source: Natural Resources Canada

Sea levels on both the Atlantic and Pacific coasts are rising but they are falling along much of the Arctic coast. The possible impacts of sea level rise depend not only on the rate of increase but on the coastline's sensitivity to higher sea levels. Sensitivity is determined by such factors as the height of the shoreline, its resistance to erosion, and the force of incoming waves.