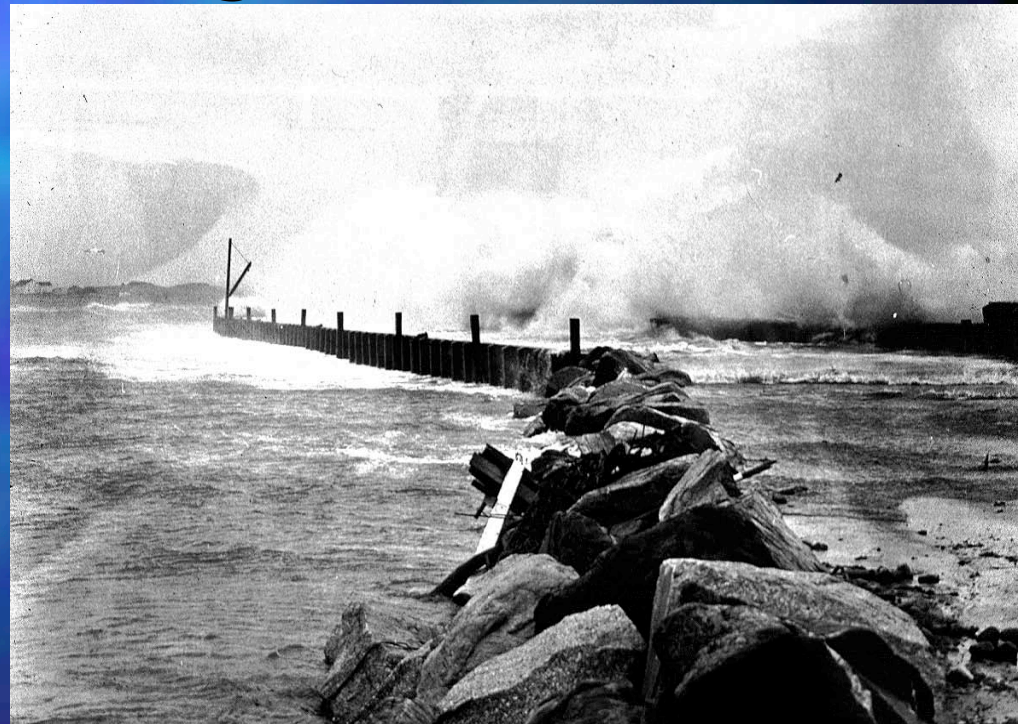


Sea-Level Rise – Focus on PEI and New Brunswick

Gary Lines
Meteorological Service of Canada
Environment Canada

Climate-Change Issues in the Coastal Zone

- *sea-level rise*
- *storms & storm-surge flooding*
- *wave climate & shoreline erosion*
- *sea ice & open-water*
- *geophysical impacts*
- *ecosystem impacts*
- *community impacts*
- *socioeconomic response*



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Impacts on

- *personal & commercial property*
- *public infrastructure*
- *natural ecosystems*
- *personal security*

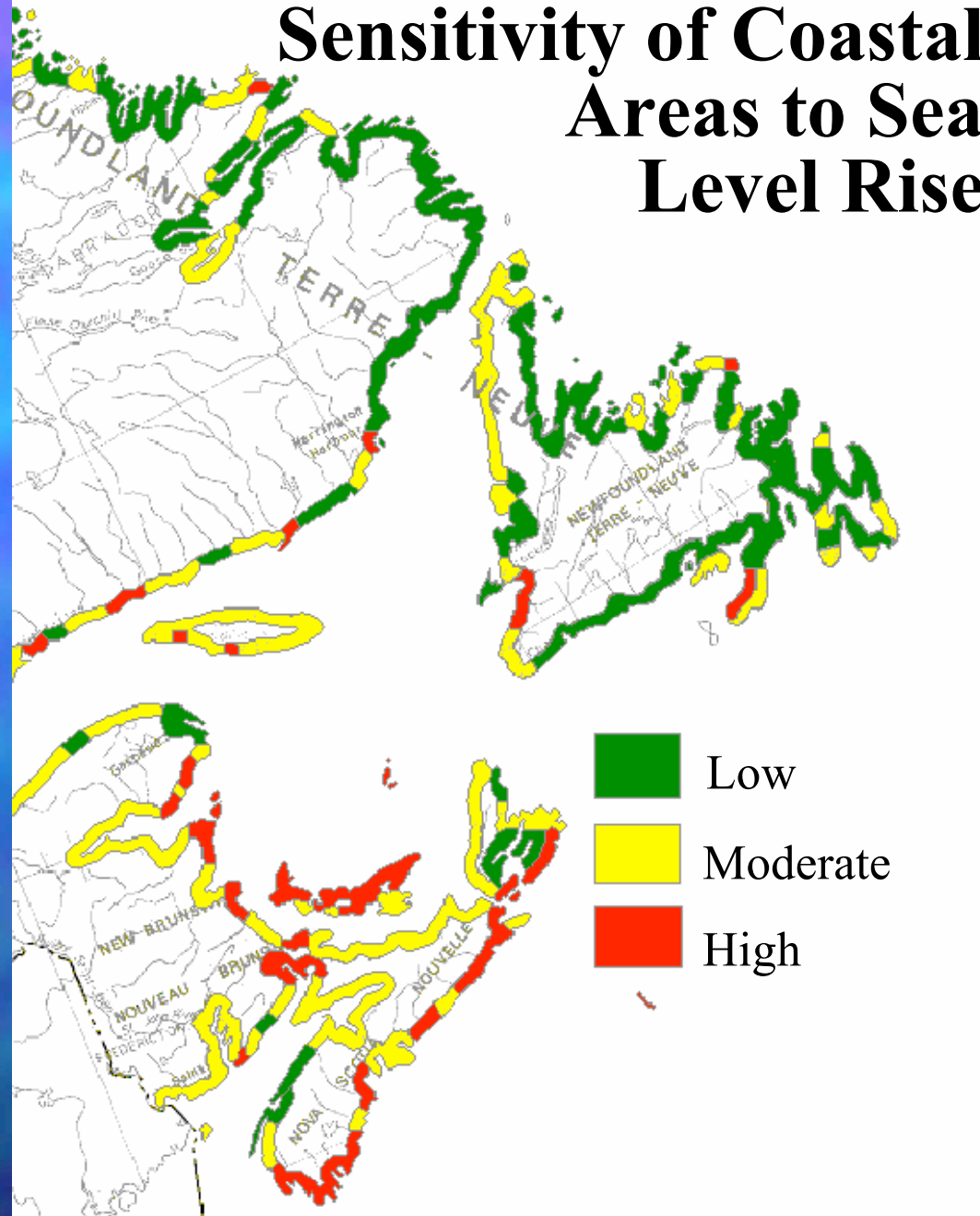
Meteorological Service of Canada

Storm-surge flooding
& coastal erosion are
problems that are with
us today!

Crustal
subsidence is
occurring...

Even without
global warming,
these problems
will get worse ...

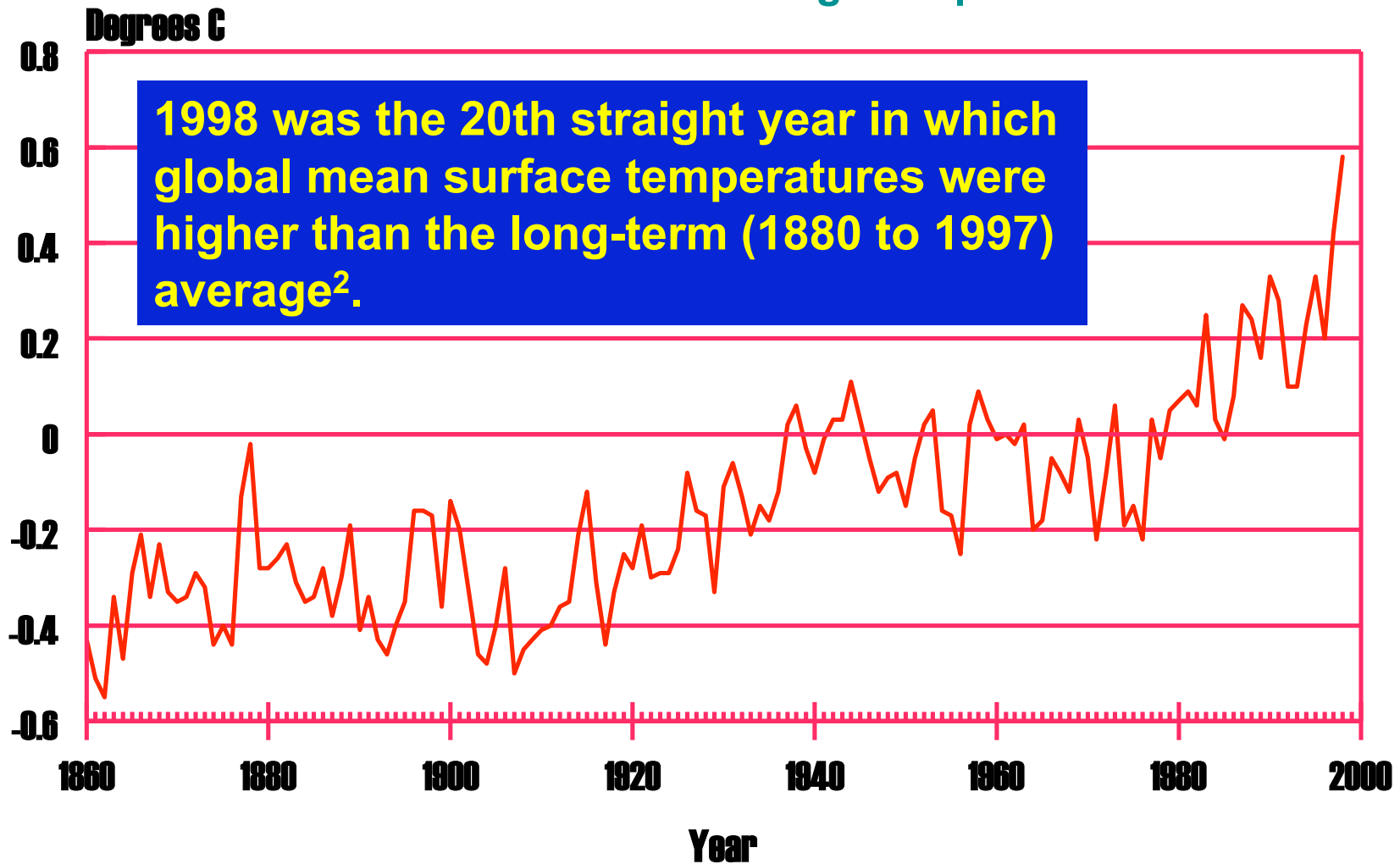
Sensitivity of Coastal Areas to Sea Level Rise



Source: Geological Survey of Canada Bulletin 505,
Sensitivity of the Coasts of Canada To Sea Level Rise, 1998.

Global Temperature Change 1860-1998

Relative to 1961-90 average temperature¹

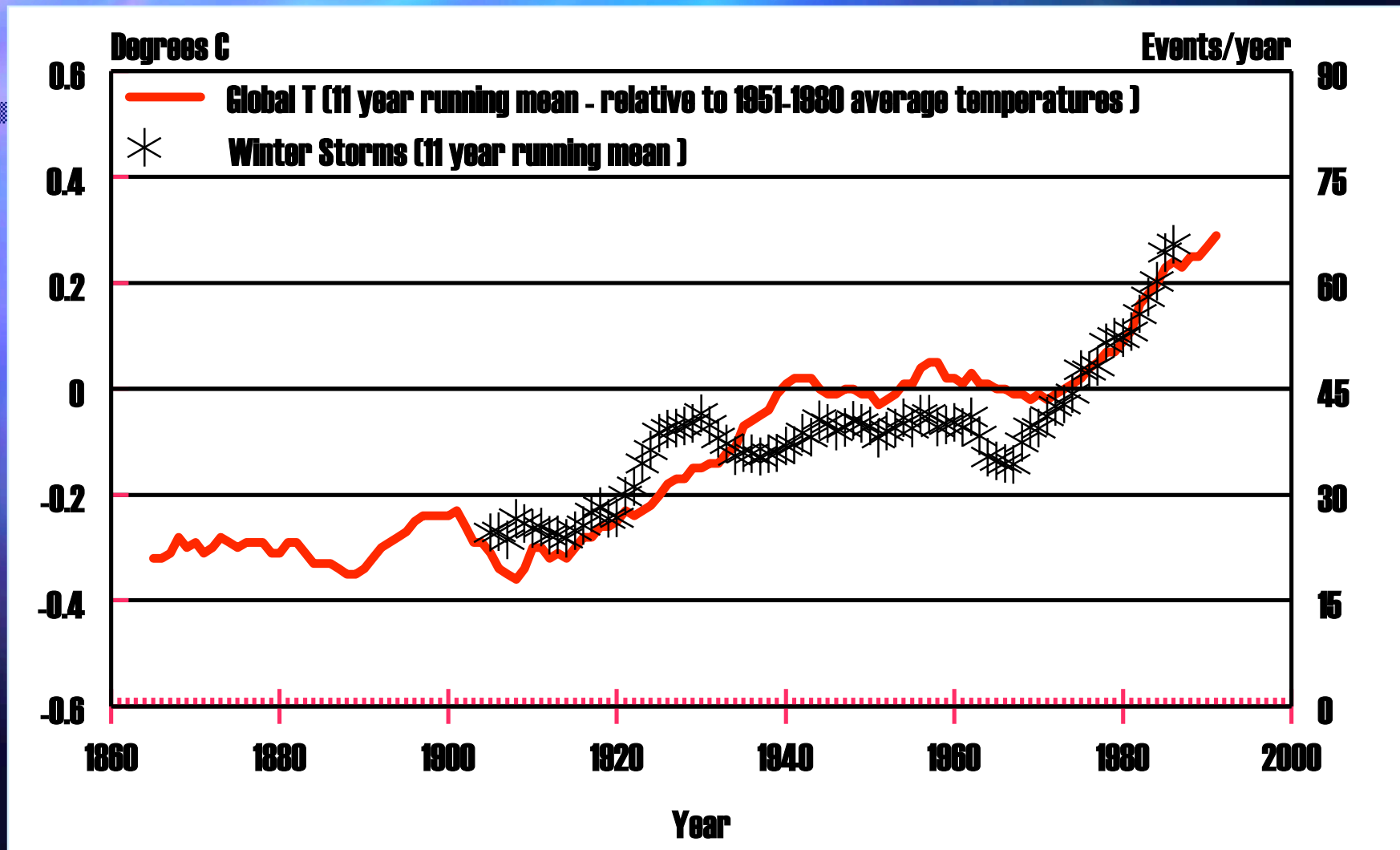


Sources:

1. Data for graph from: www.ncdc.noaa.gov/ol/climate/research/1997/globet3.txt

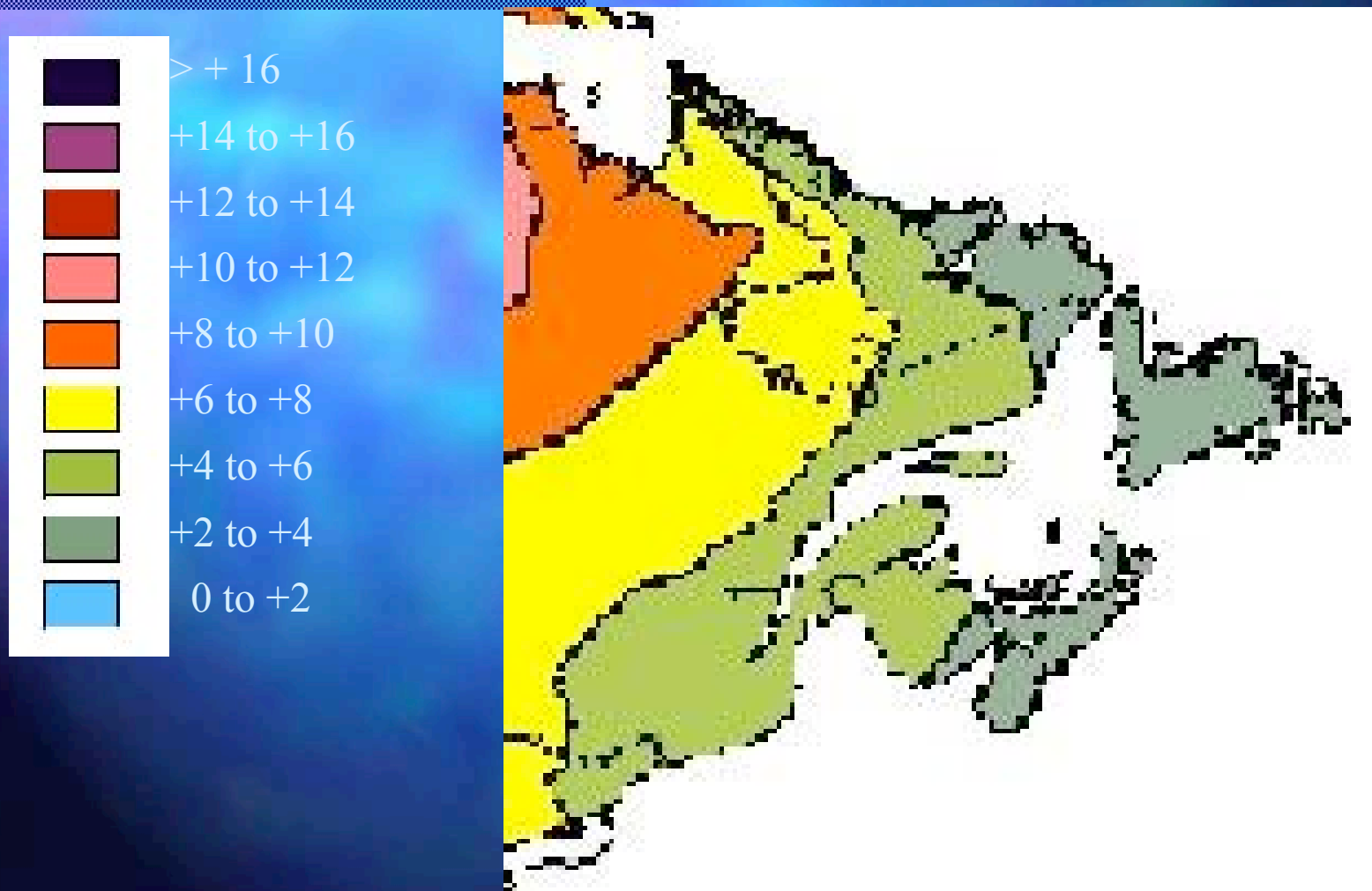
2. National Oceanic and Atmospheric Administration, Climate of 1998, Annual Review, January 12, 1999

Changes in Global Temperature And Northern Hemisphere Intense Winter Storm Frequency



Source of storm frequency data: Lambert, S.J., Intense Extratropical Northern Hemisphere Winter Cyclone Events: 1899-1991, Journal of Geophysical Research, Vol 101, No. D16, Pages 21319-21325, Sept. 27, 1996.

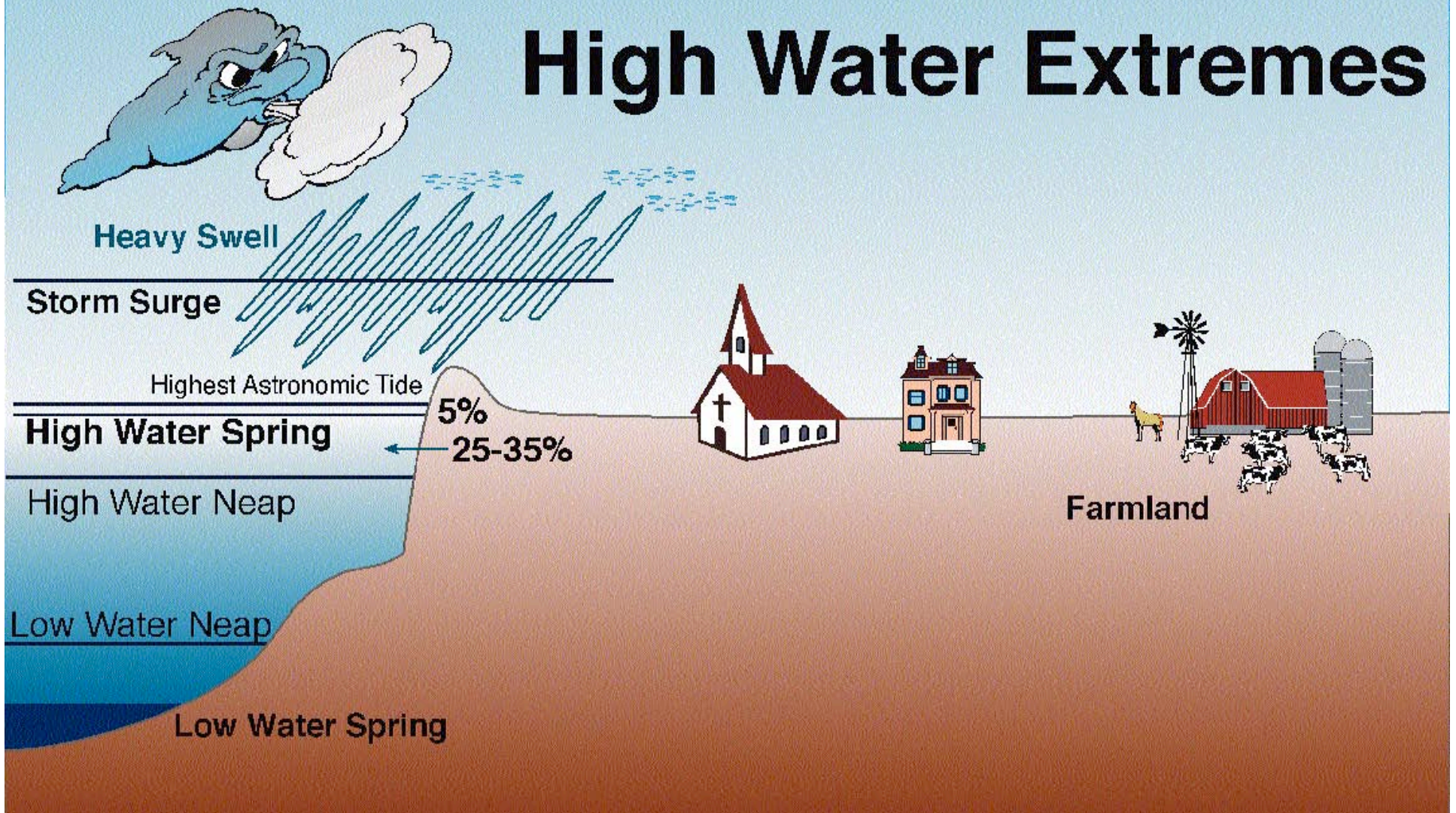
Projected Temperature Increase - Winter 2090 (December, January, February)



Source: Adaptation and Impacts Research (AIR) Group, Environment Canada, 1999

Storm Surge

High Water Extremes



Storm Surge and Coastal Erosion

- Recent events
 - January 21st, 2000
 - October 29th, 2000



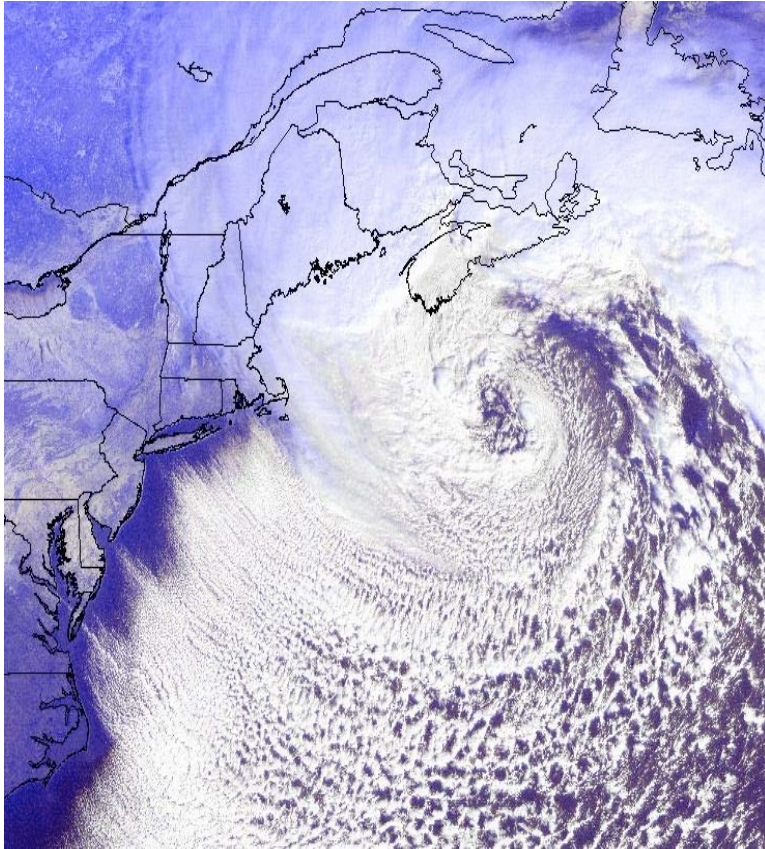
Photo credit: Bob Belliveau



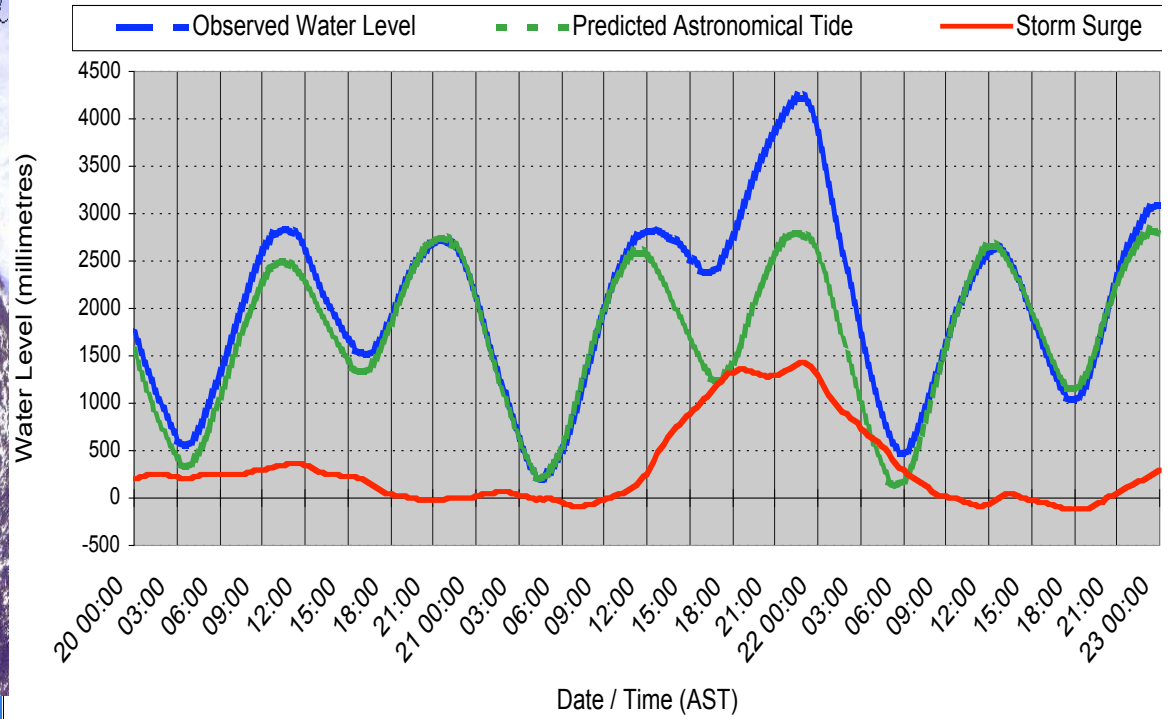
Measured and Projected Sea-Level Rise

- Results from a recently completed PEI Sea Level Rise Study.
 - area RSLR ~ 30 cm/century
 - global SLR ~ 10 cm/century
 - crustal subsidence ~ 20 cm/century
 - global SLR projections ~ 50 cm \pm 40 cm to 2100 AD
 - RSLR to 2100 AD = $\sim 70 \pm 40$ cm

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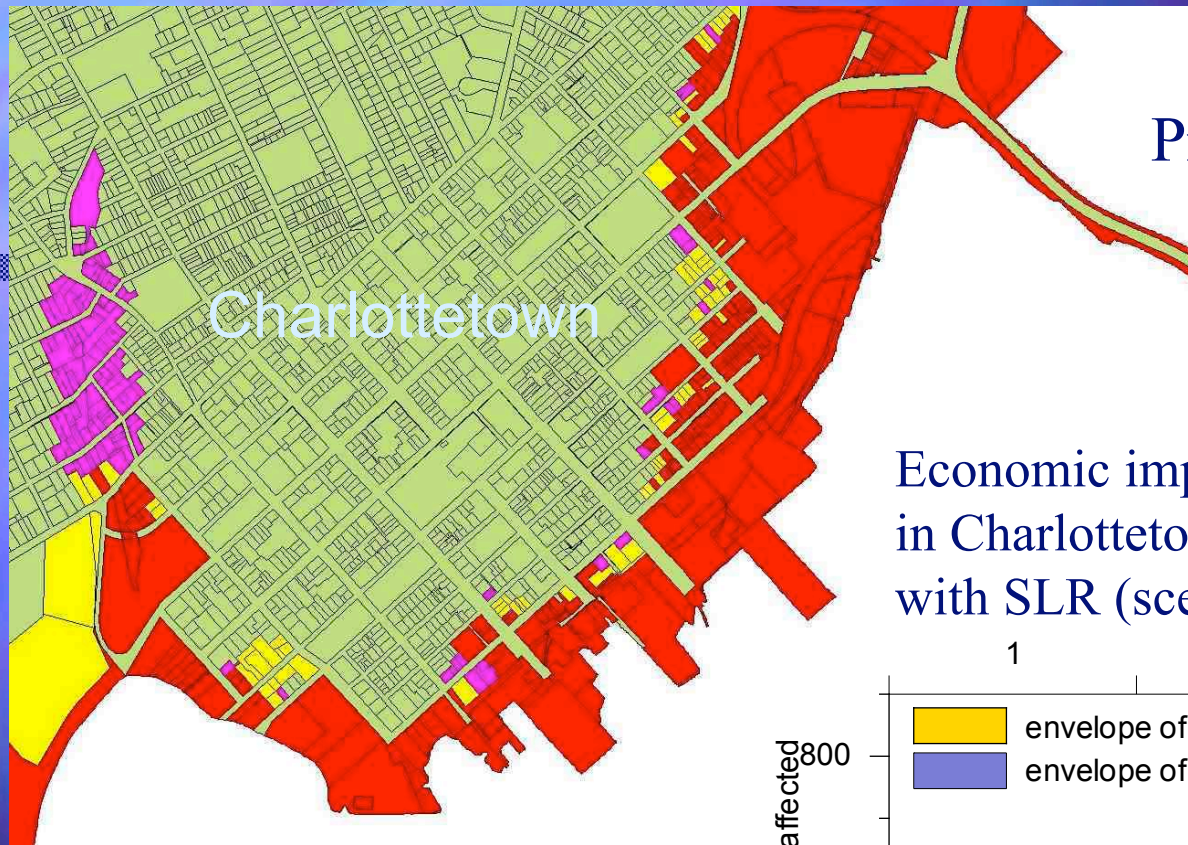


Charlottetown, PEI - Storm Surge - January 21, 2000



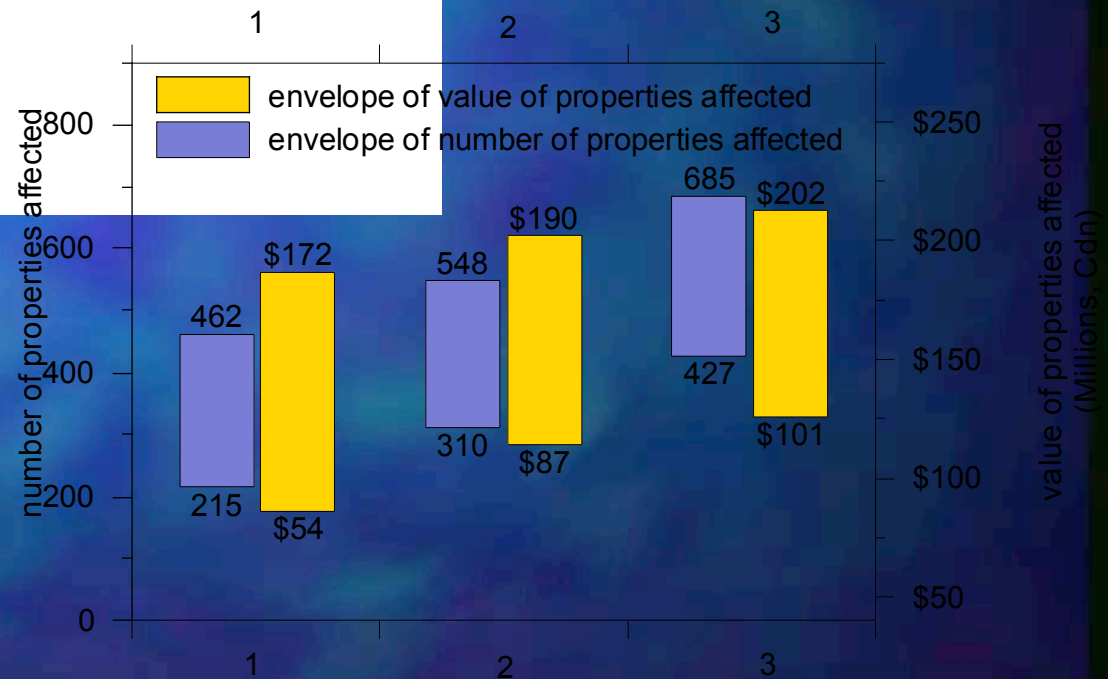
courtesy ATV





Properties at risk

Economic impact of storm-surge flooding in Charlottetown now (scenario 1) and with SLR (scenarios 2 & 3)



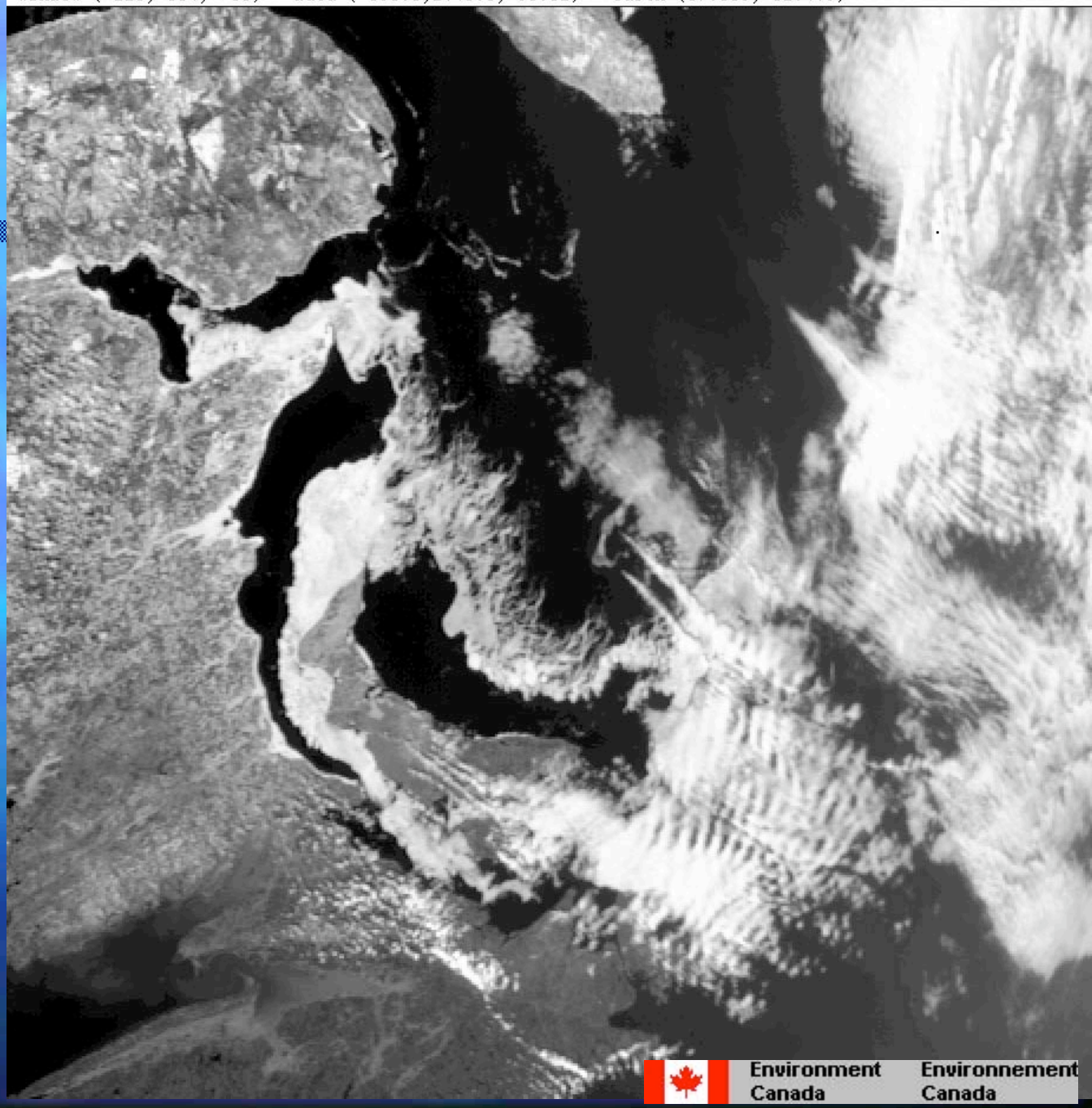
Municipal infrastructure at risk ... > \$48M

Heritage properties at risk ... 49 @ \$11.3M

Ice in the Gulf of St Lawrence 26 Mar 1999

*Reduced winter
ice in future
warmer climate
may lead to
increased winter
storm wave
activity and
coastal damage*

window (226, 864, 35) data (398.8,2143.8, 93.82) earth (37.569,-62.419)



Erosion risk to coastal lands on the North Shore

past losses

value of land lost, 1935 - 1990
value of land lost, 1980/81 - 1990

cottage

\$ 816,000.00
\$ 242,000.00

non-cottage

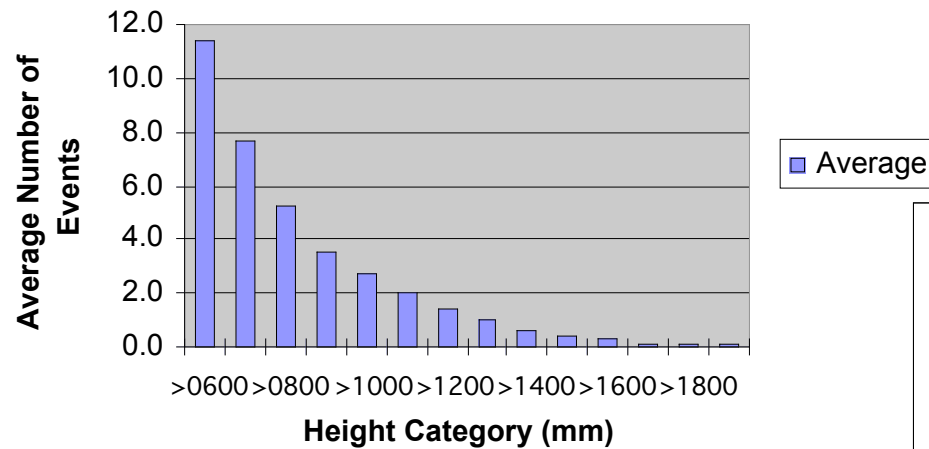
\$ 63,400.00
\$ 10,600.00

100-year erosion forecast (all properties)

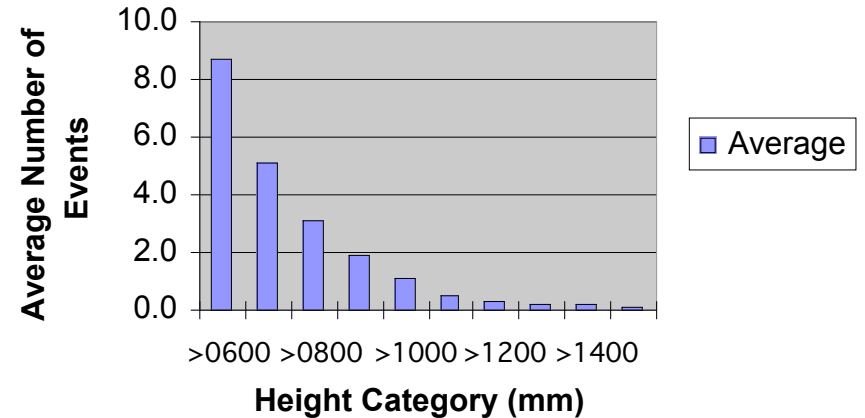
	Current Total	Erosion 1.0x	Erosion 1.5x	Erosion 2.0x
Area	703 ha	34.7 ha	52.1 ha	69.5 ha
Value	\$2.6 M	\$638 K	\$957 K	\$1.28 M
% of Current Value		24.6%	36.9%	49.1%

Storm Surge

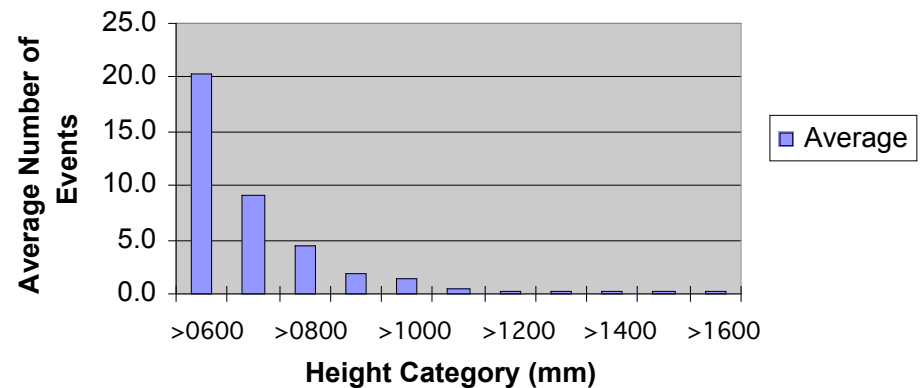
Point du Chene - Average Yearly Events by Category (7 years)



Escuminac - Average Yearly Events by Category (10 years)



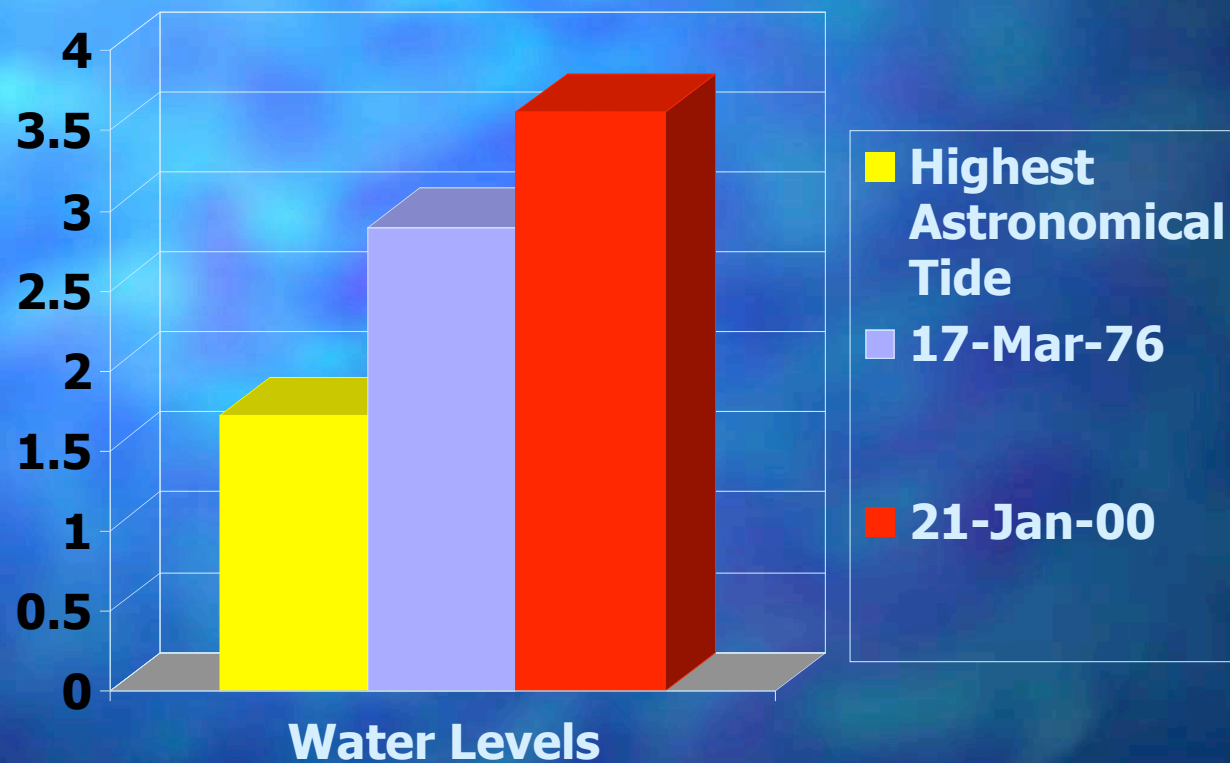
Dalhousie - Average Yearly Events by Category (6 years)

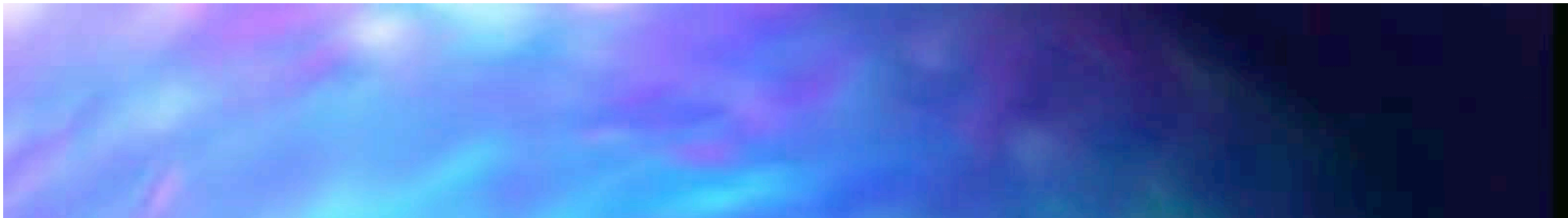


■ Events:

- >60 cm - 10 to 20
- >1m - 1 to 3

Record Water Level in Point-de-Chene





Pointe-Du-Chene



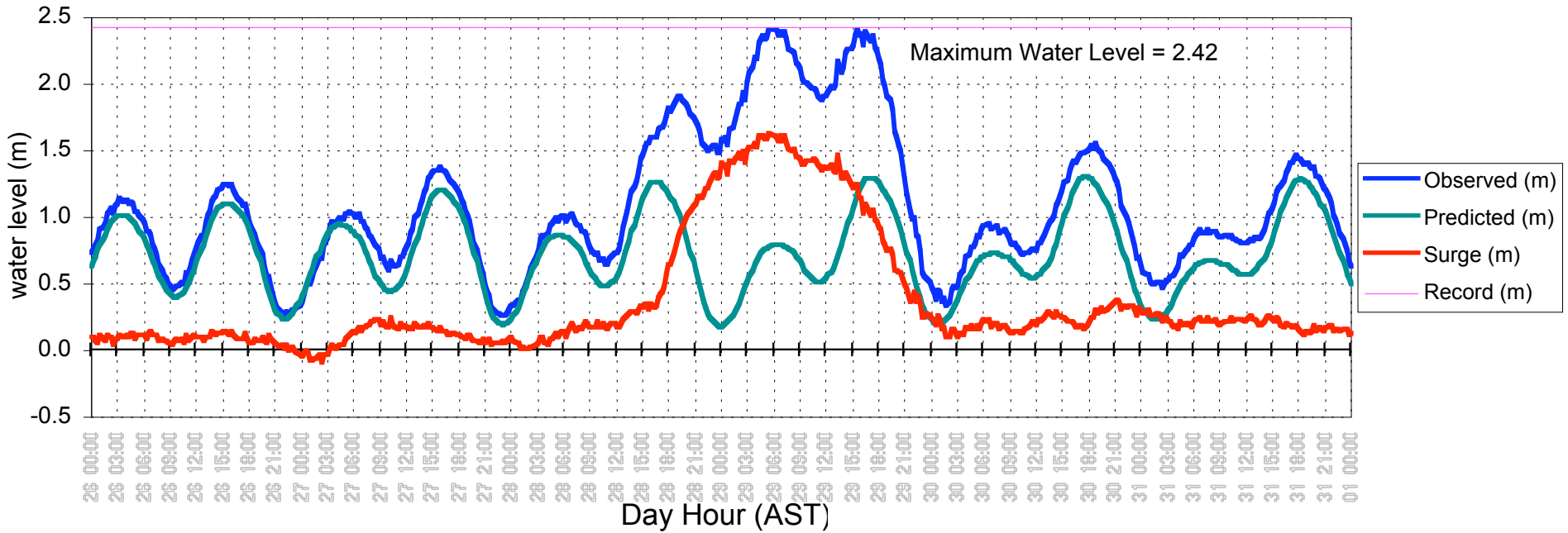
Cap-des-Caissie



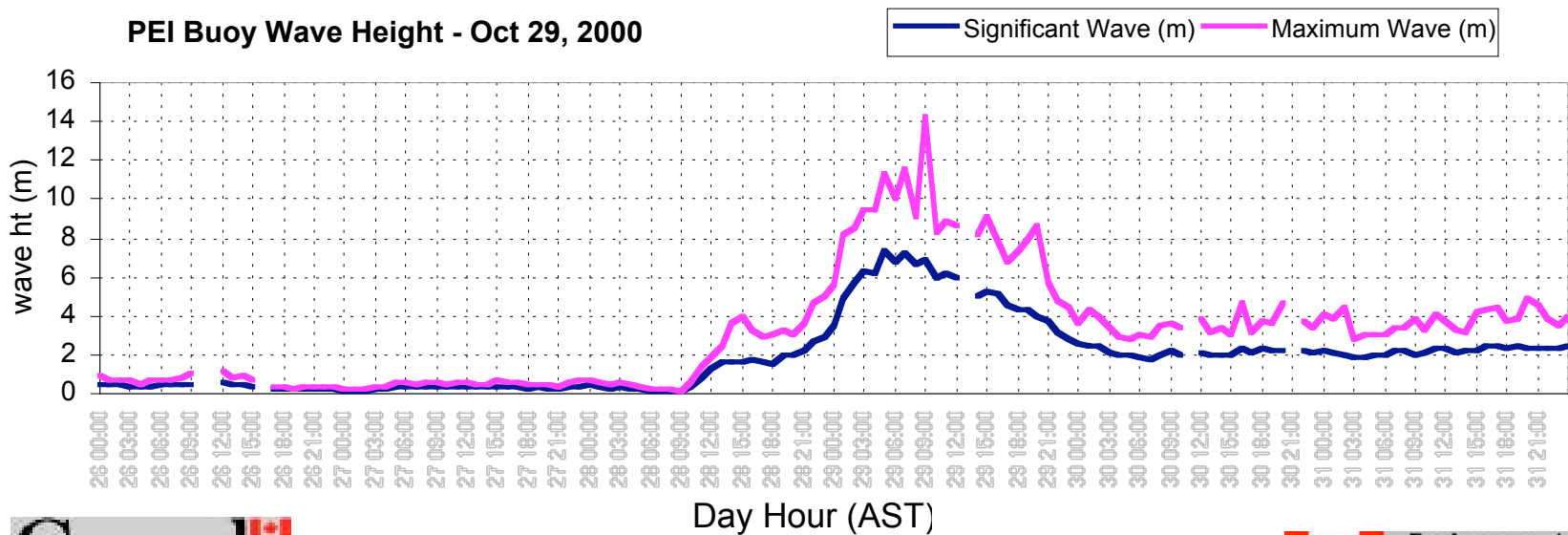
Bouctouche Bay



Escuminac Storm Surge - Oct 29, 2000 - (Nov 21, 1988 Record = 2.43 m)



PEI Buoy Wave Height - Oct 29, 2000



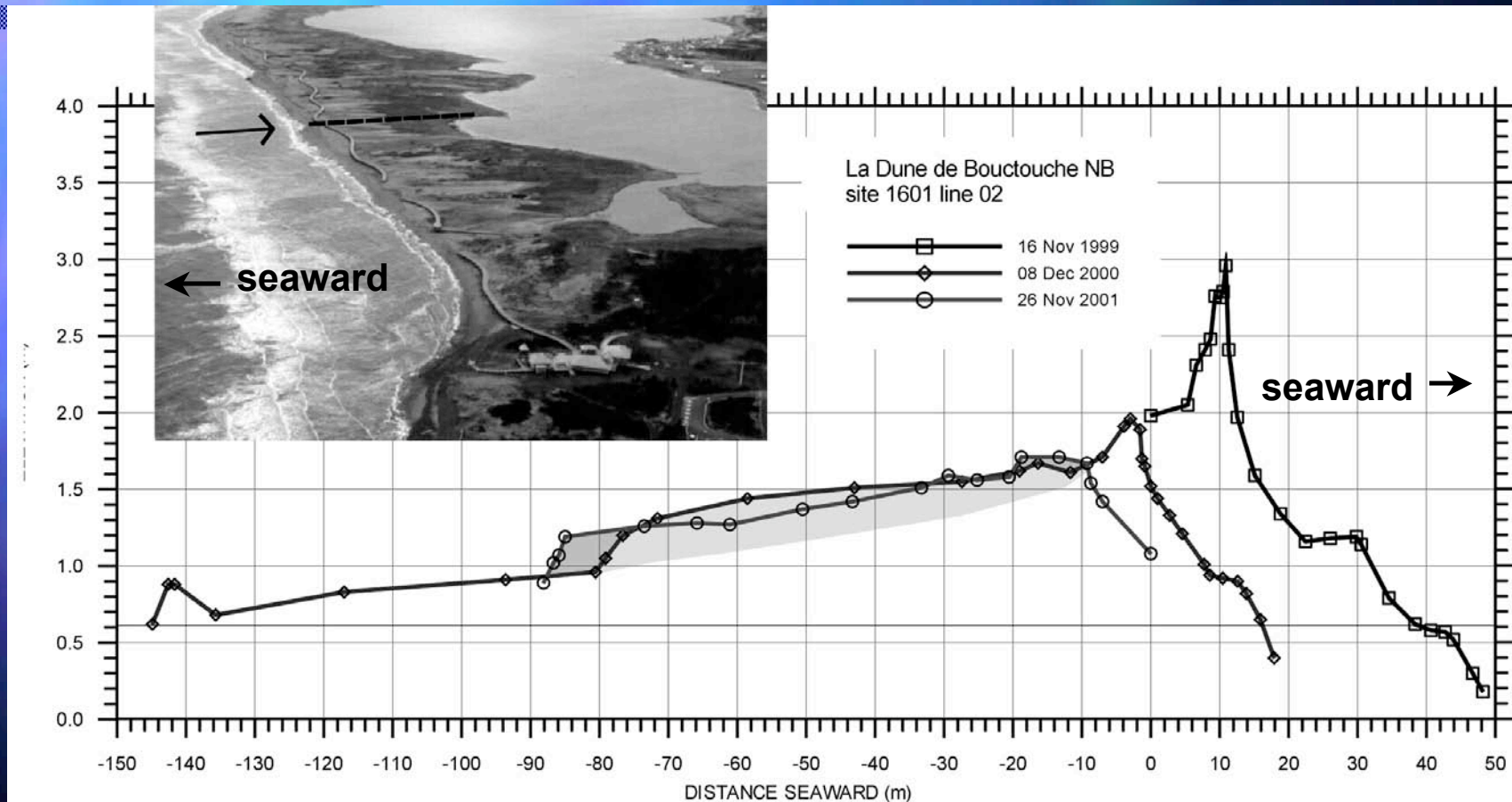
Changing the Landscape



Washover sand sheets and infrastructure damage at La Dune de Bouctouche NB following storm of 29 October 2000

Successive profiles across La Dune de Bouctouche spit

- November 1999
- December 2000 following October 2000 storm
- November 2001 following storm earlier in that month



New Brunswick Sea-Level Rise Project Overview

***"The Impacts of Sea-Level Rise and
Climate Change on the Coastal Zone of
Southeastern New Brunswick"***

Locations of Height Validation Surveys



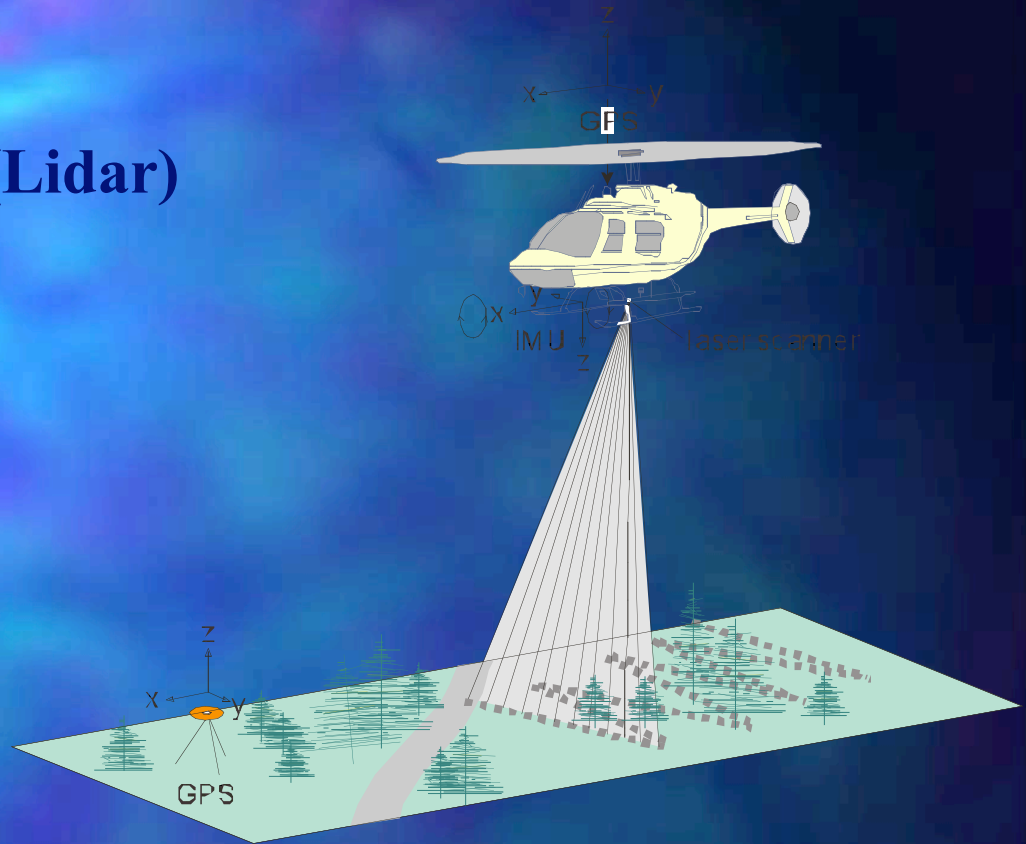
Project Objective

Quantify impacts of climate change and more specifically sea-level rise, storm surge and coastal erosion on the Gulf of St. Lawrence coastal zone of southeastern New Brunswick, in support of sustainable management, community resilience and the development of adaptation strategies.

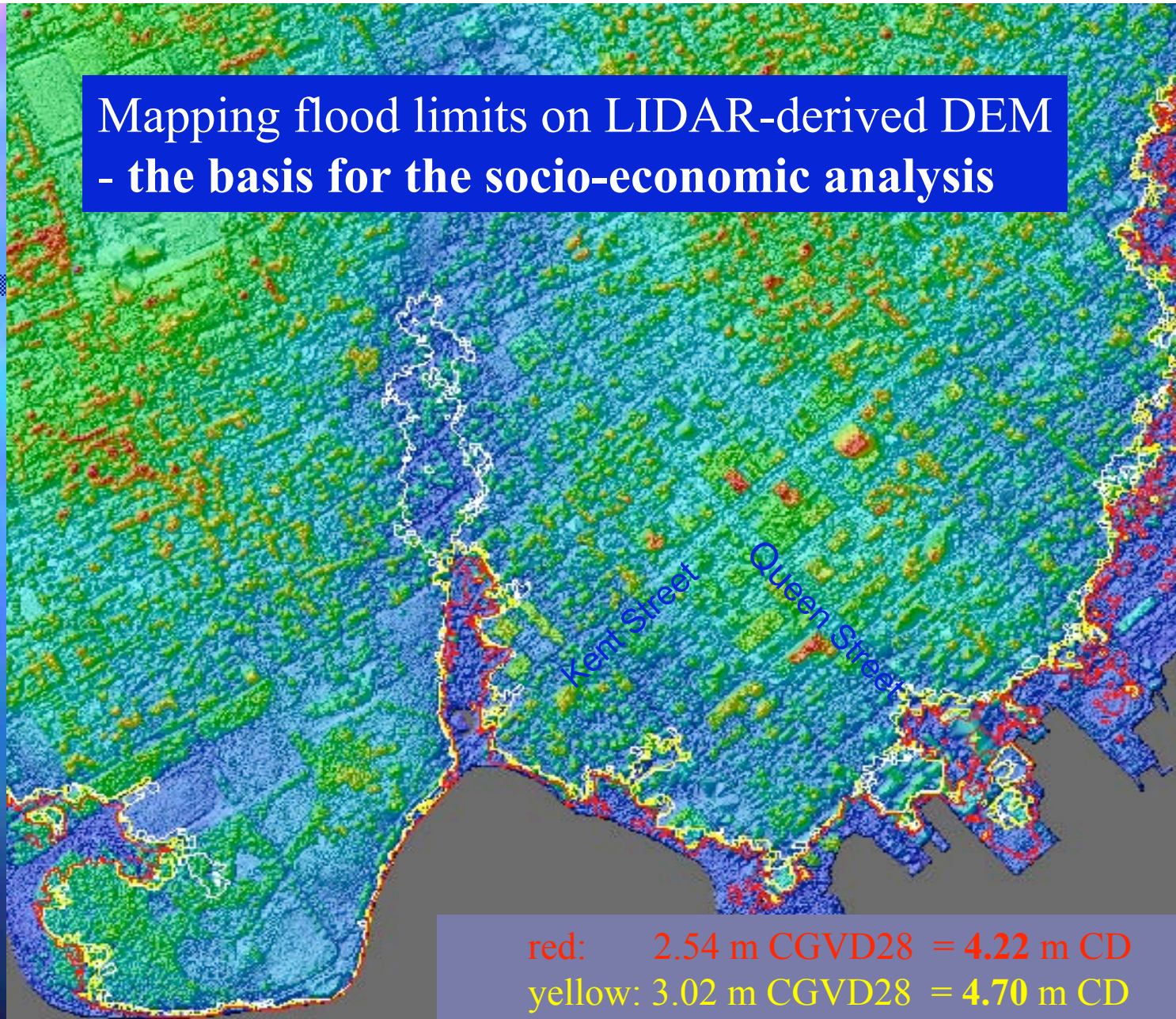
Airborne laser altimetry (Lidar)



- used to build digital elevation models (DEMs) onshore

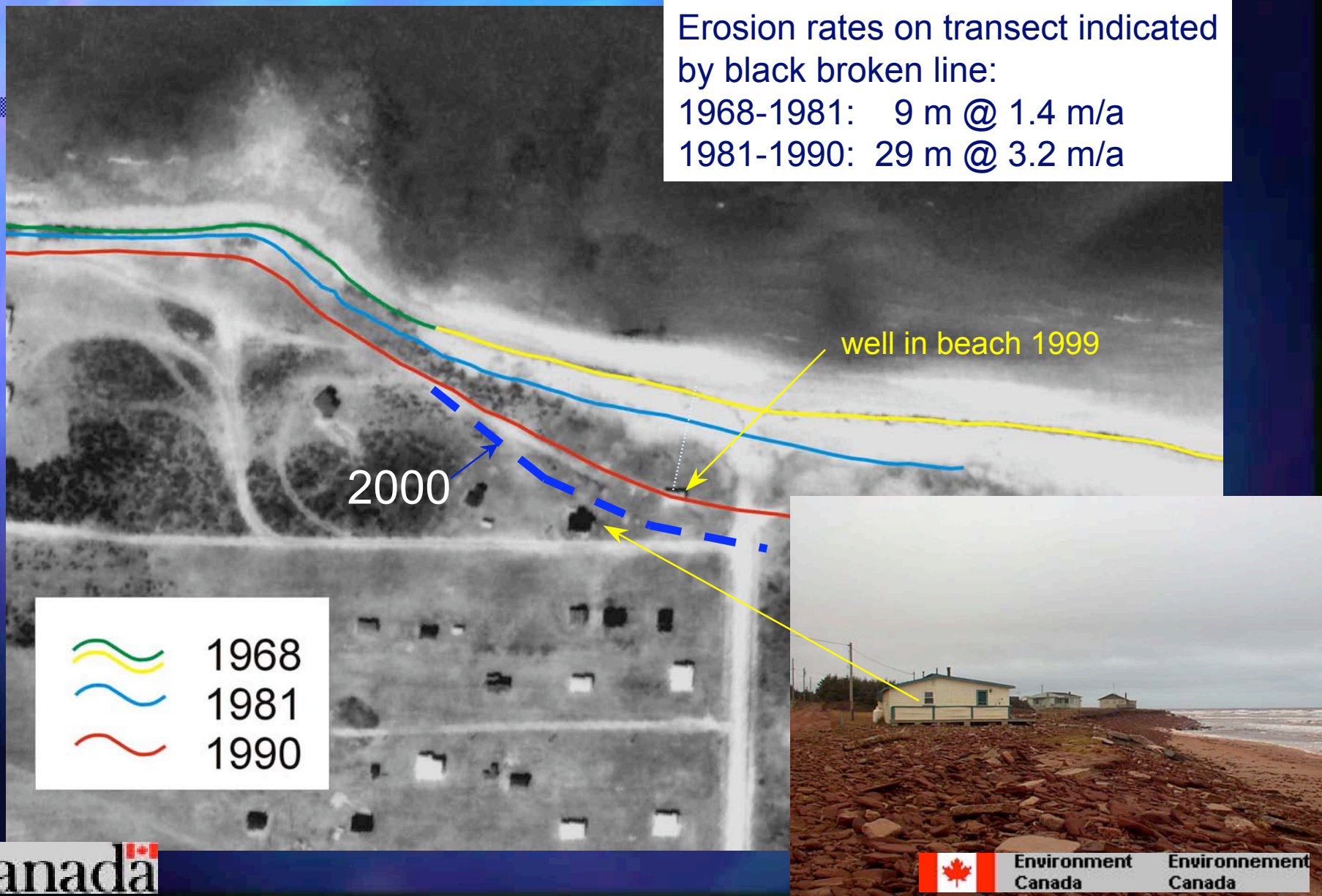


Mapping flood limits on LIDAR-derived DEM - the basis for the socio-economic analysis

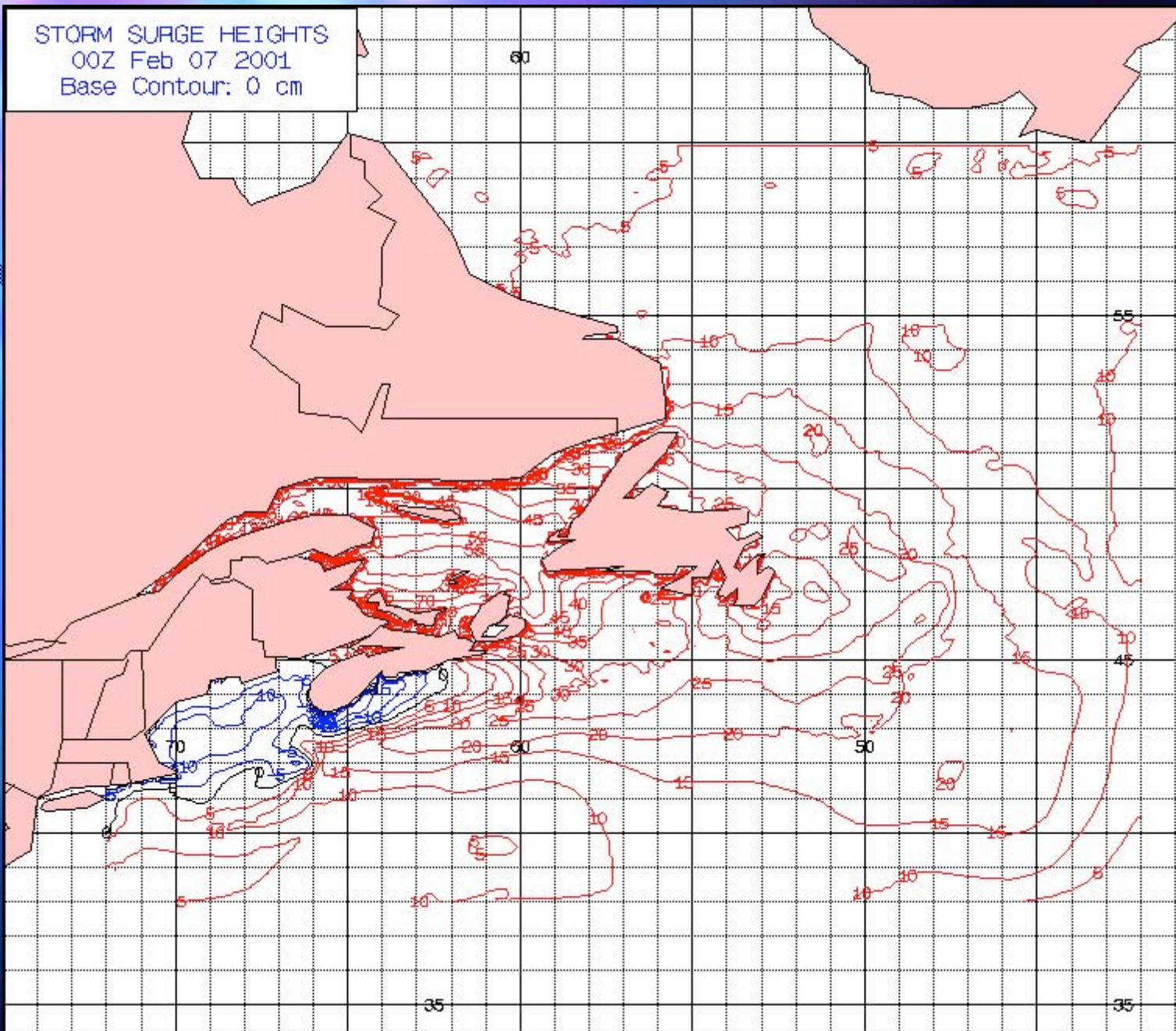


red: 2.54 m CGVD28 = 4.22 m CD
yellow: 3.02 m CGVD28 = 4.70 m CD
white: 3.25 m CGVD28 = 4.93 m CD

Coastal retreat at Pigots Point, PEI



STORM SURGE HEIGHTS
00Z Feb 07 2001
Base Contour: 0 cm



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Environment
Canada

Environnement
Canada

Project Deliverables (2003-2006)

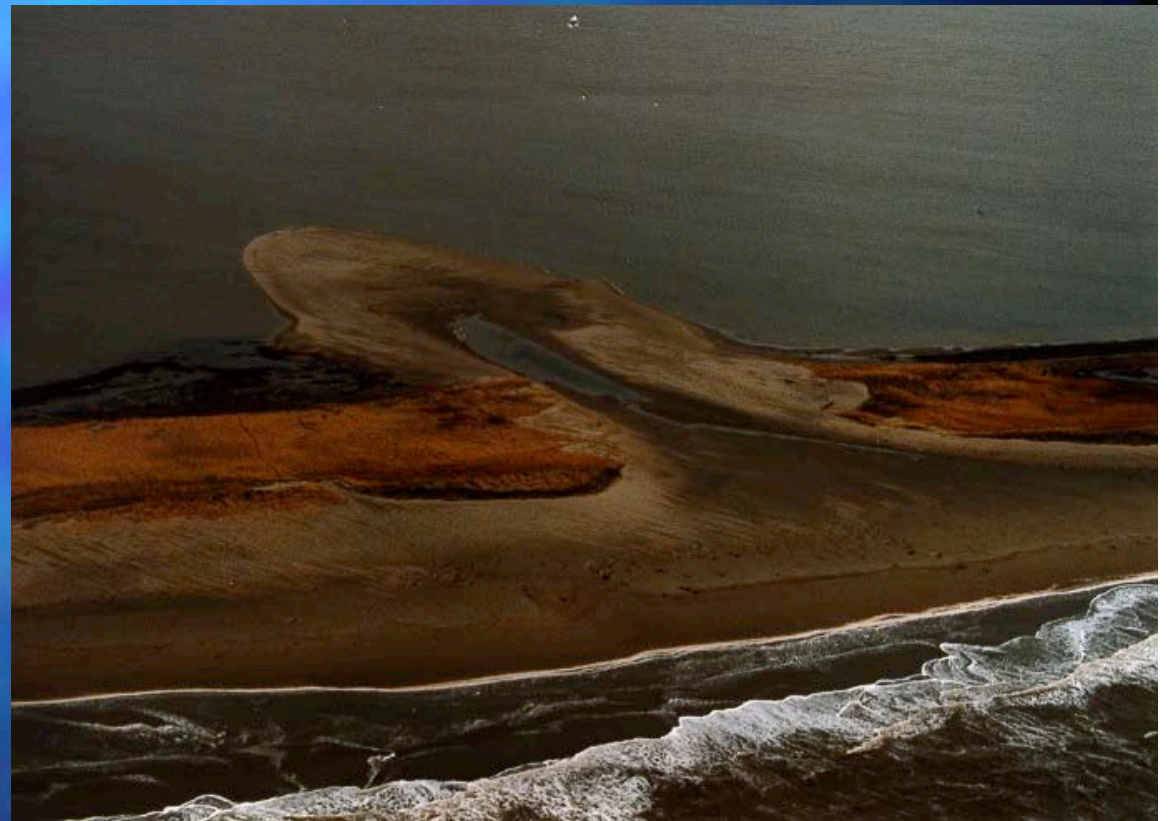
To policy makers and the local communities:

- Identification of anticipated Sea-Level Rise and Storm Surge effects in the coastal zone;
- Assessment of associated impacts;
- Better understanding of vulnerability in coastal communities and the impacts on residents' lives and livelihood;
- Delineation of hazard zones and suggested adaptation strategies - Protection, Accommodation, and Retreat or Avoidance (applicable to coastal areas protection policy)

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Application of Outcomes

- La Dune Breach
 - Impacts on Aquaculture
 - The future of its infrastructure



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Application of Outcomes

- Parlee Beach
(Beach Nourishment Program)
 - Designing more natural and resistant beach systems



Meteorological Service of Canada

Project team

- *Environment Canada*
- *Natural Resources Canada*
- *Department of Fisheries and Oceans*
- *Parks Canada*
- *New Brunswick Government*
- *Dalhousie University*
- *Centre of Geographic Sciences*
- *University of New Brunswick*
- *Université de Moncton*
- *Mount Allison University*
- *La Dune de Bouctouche*

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