Coastal Impacts and Adaptation Issues

Gary Lines

Climate Change Meteorologist

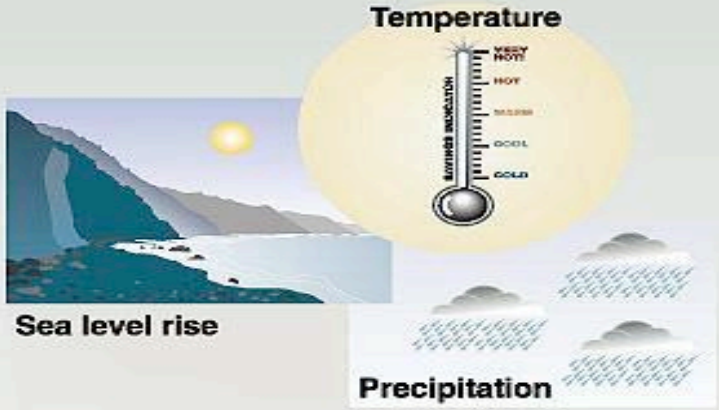
Meteorological Service of Canada Atlantic

Stephen Schneider (Stanford University)

"Don't be poor in a hot country, don't live in hurricane alley, watch out about being on the coasts or in the Arctic, and it's a bad idea to be on high mountains with glaciers melting."

(*Associated Press*, 07/04/08)

Potential climate changes impact



Impacts on...

Health	Agriculture	Forest	Water resources	coastal areas	Species and natural areas
					
Weather-related mortality Infectious diseases Air-quality respiratory illnesses	Crop yields Irrigation demands	Forest composition Geographic range of forest Forest health and productivity	Water supply Water quality Competition for water	Erosion of beaches Inundation of coastal lands additional costs to protect coastal communities	Loss of habitat and species Cryosphere: diminishing glaciers

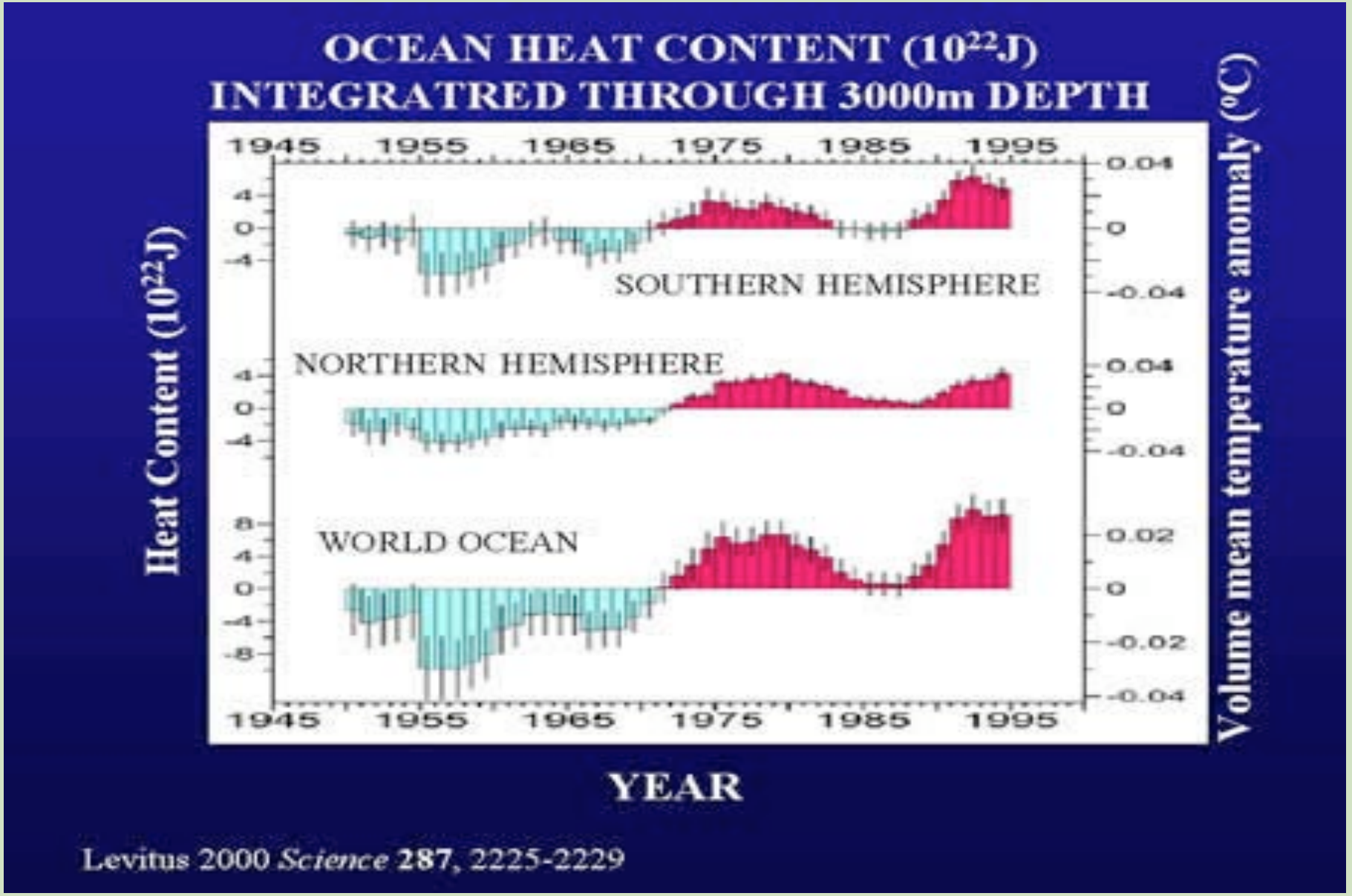
GRID Arendal UNEP

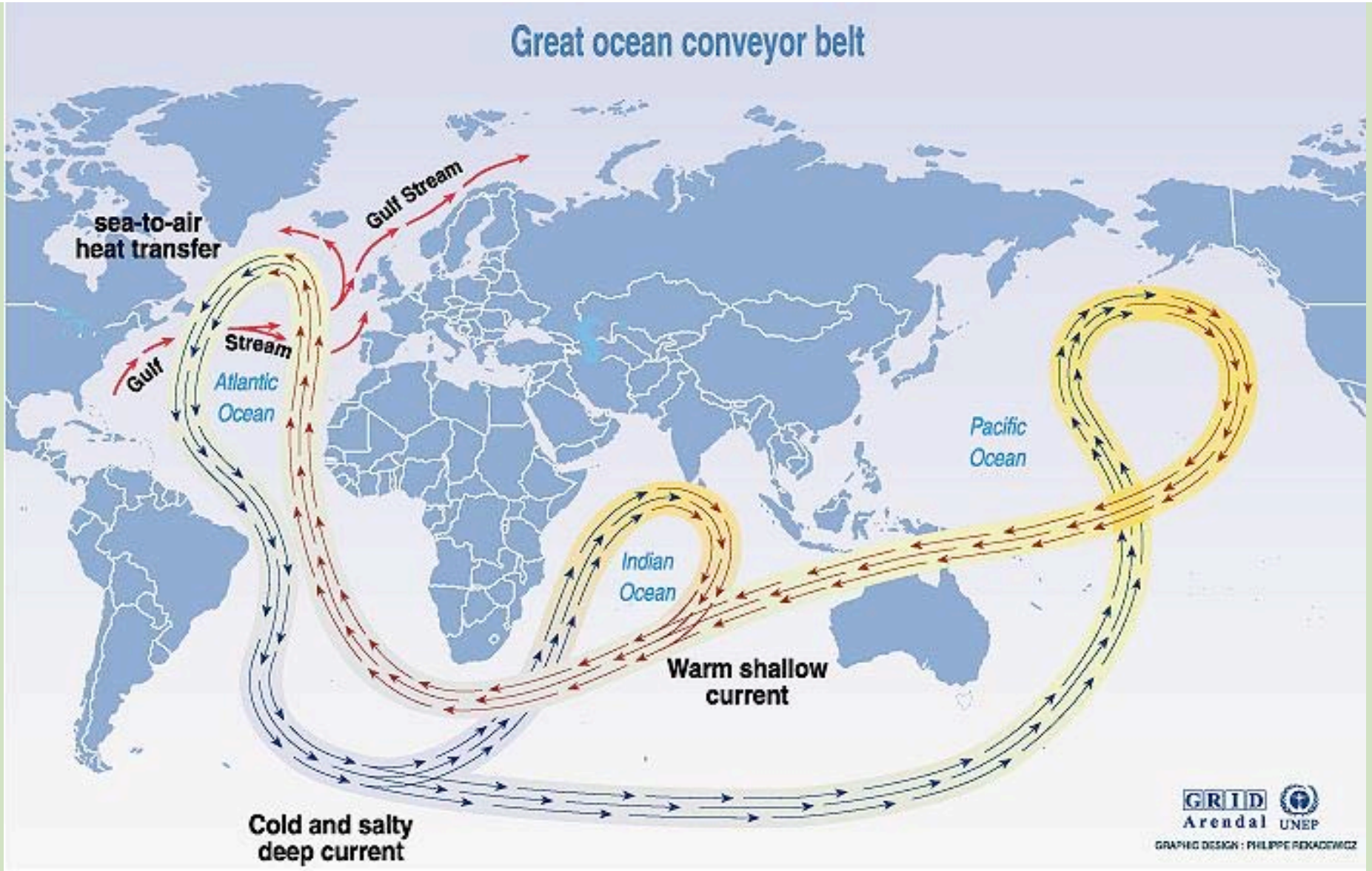
GRAPHIC DESIGN : PHILIPPE REKACEWICZ

Source: United States environmental protection agency (EPA).

PROJECTIONS OF FUTURE CHANGES IN CLIMATE

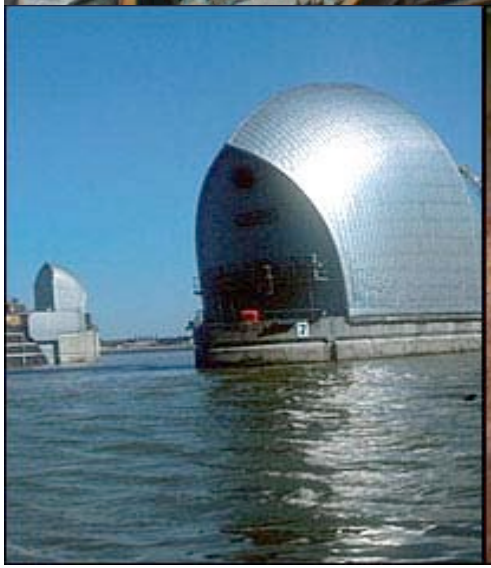
- *Very likely* that hot extremes, heat waves, and heavy precipitation events will continue to become more frequent
- *Likely* that future tropical cyclones will become more intense, with larger peak wind speeds and more heavy precipitation
  - ***less confidence in total numbers***
- Extra-tropical storm tracks projected to move poleward with consequent changes in wind, precipitation, and temperature patterns


OCEAN HEAT CONTENT (10^{22}J)
INTEGRATRED THROUGH 3000m DEPTH
Heat Content (10^{22}J)
Volume mean temperature anomaly (°C)
SOUTHERN HEMISPHERE
NORTHERN HEMISPHERE
WORLD OCEAN
1945
1955
1965
1975
1985
1995
YEAR
Levitus 2000 Science 287, 2225-2229

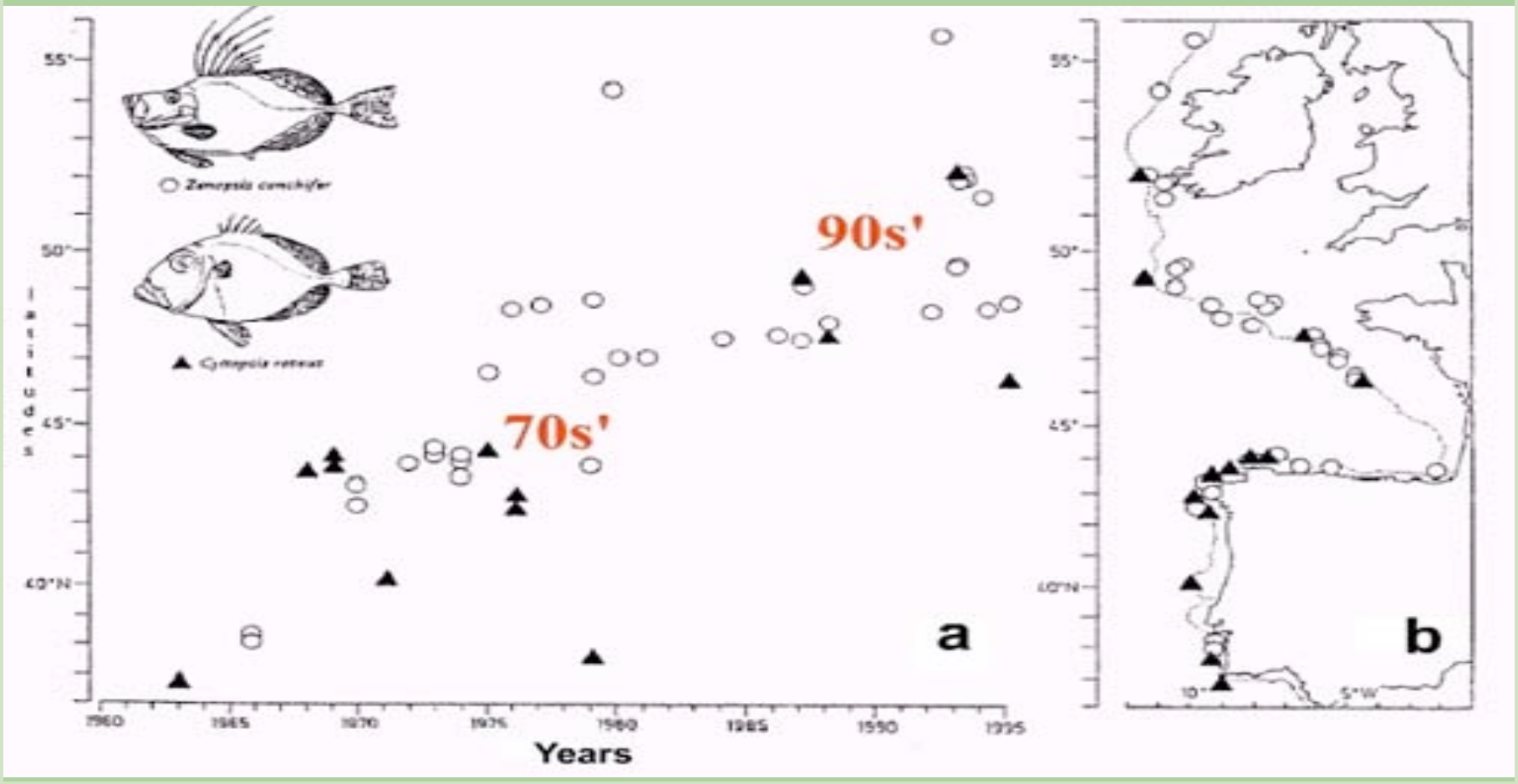


Source: Broecker, 1991, in Climate change 1995, Impacts, adaptations and mitigation of climate change: scientific-technical analyses, contribution of working group 2 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge press university, 1996.

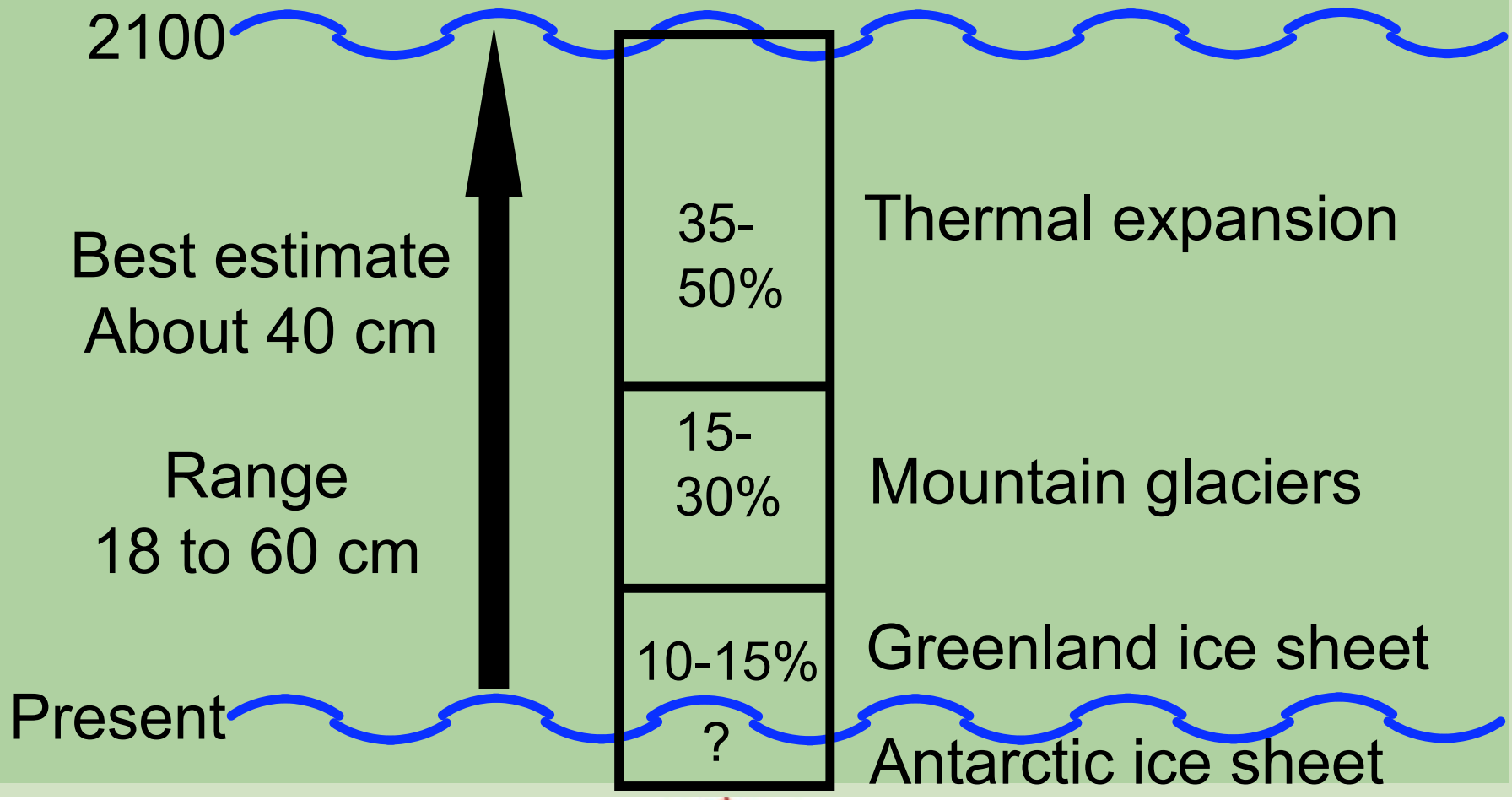
Marine Impacts



Migration of Species



Projected Global Sea Level Rise to 2100



Source: *Summary for Policy Makers, WG I Report,* Intergovernmental Panel on Climate Change (IPCC), *Feb , 2007.*

Impacts on Wetland Migration

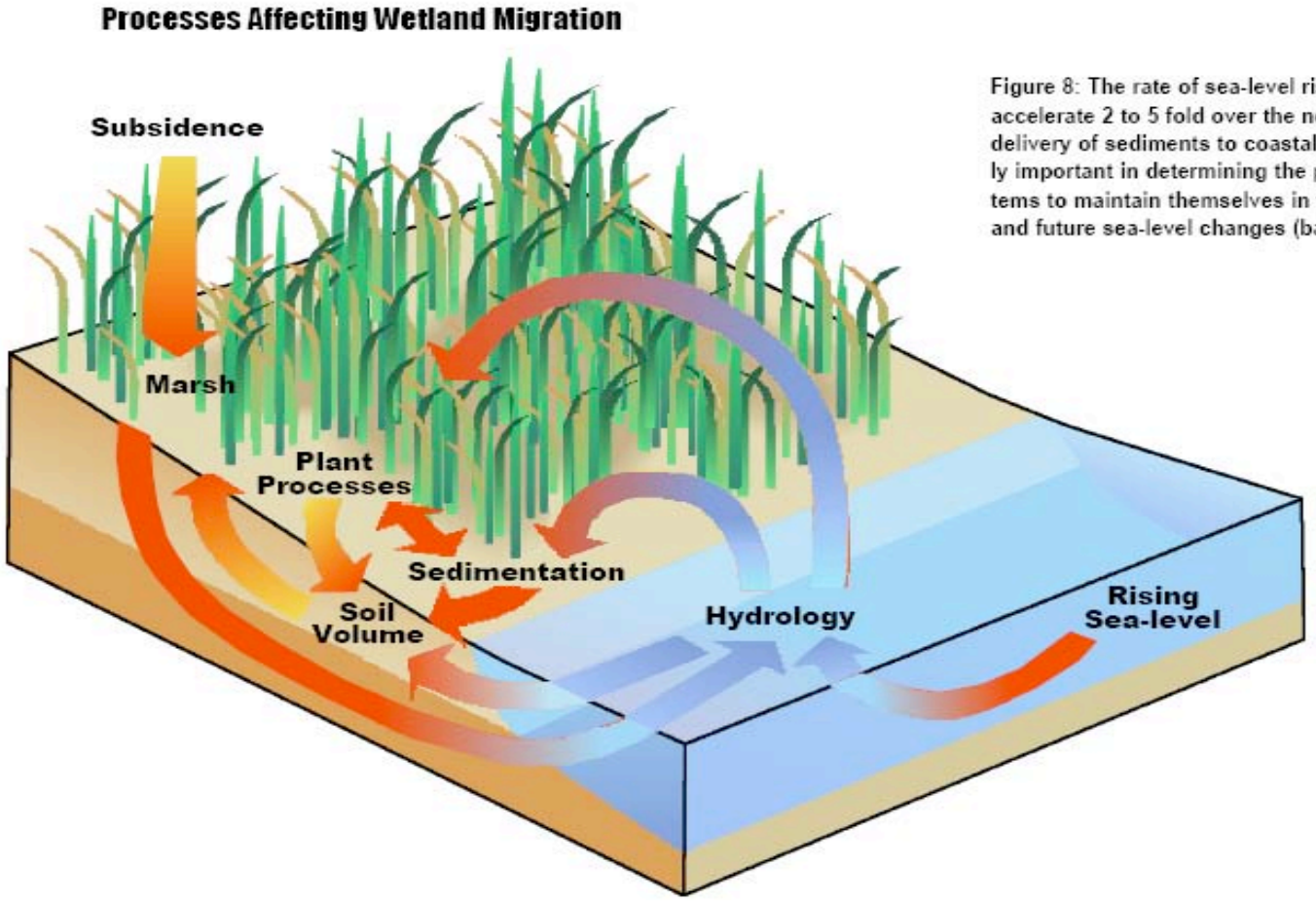


Figure 8: The rate of sea-level rise is projected to accelerate 2 to 5 fold over the next 100 years. The delivery of sediments to coastal wetlands is extremely important in determining the potential of these systems to maintain themselves in the face of current and future sea-level changes (based on Reed, 1995).

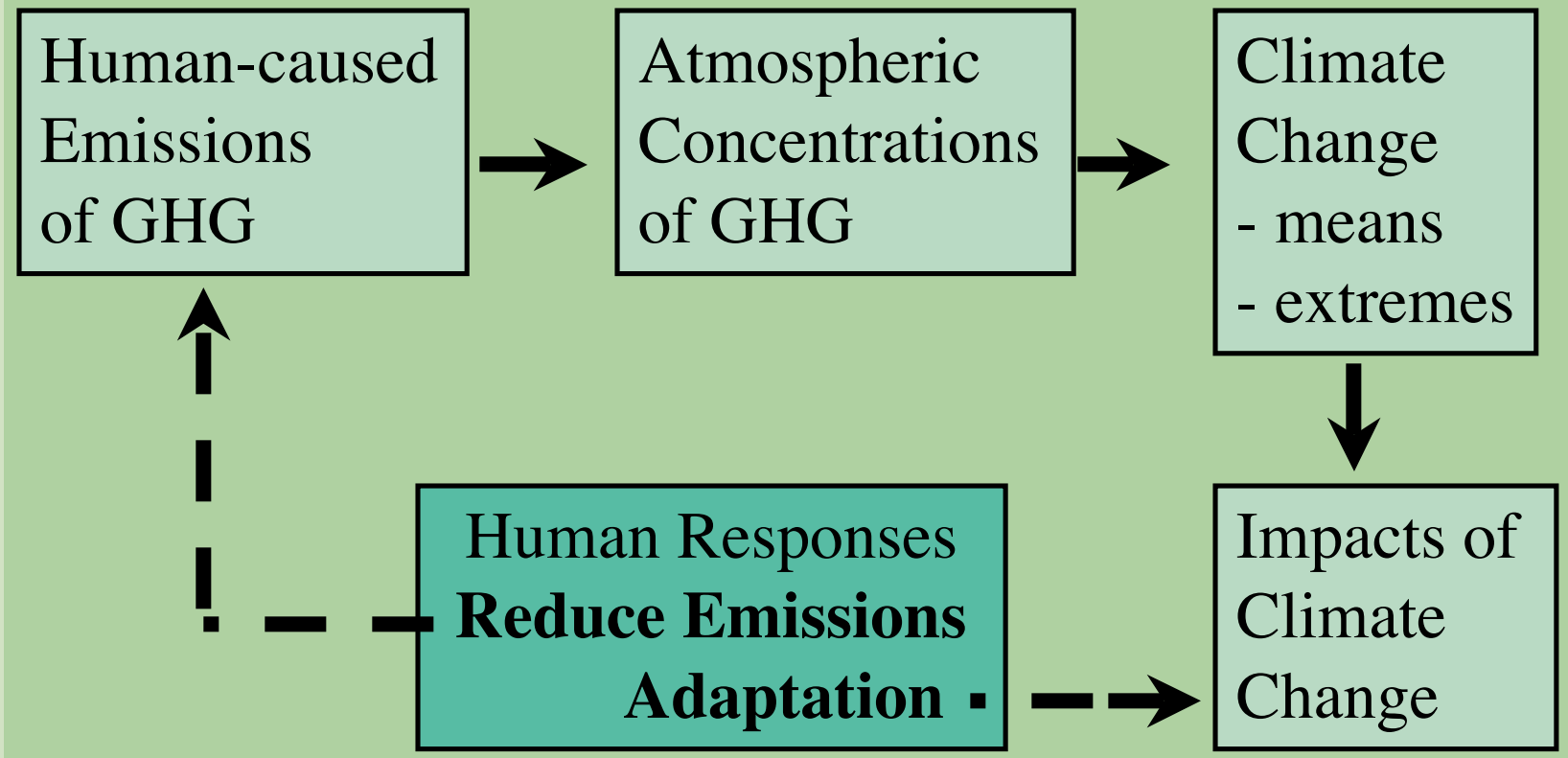
Source: US National Assessment of the Potential Consequences of Climate Variability and Change: Coastal Areas and Marine Resources, August 2005.

Sea Level Rise & Transportation

Main CN Line Near Amherst, NS

Photo Credit:
Con Desplanque,
Amherst, NS

Relationship of Human Caused Greenhouse Gas Emissions to Climate Change Impacts

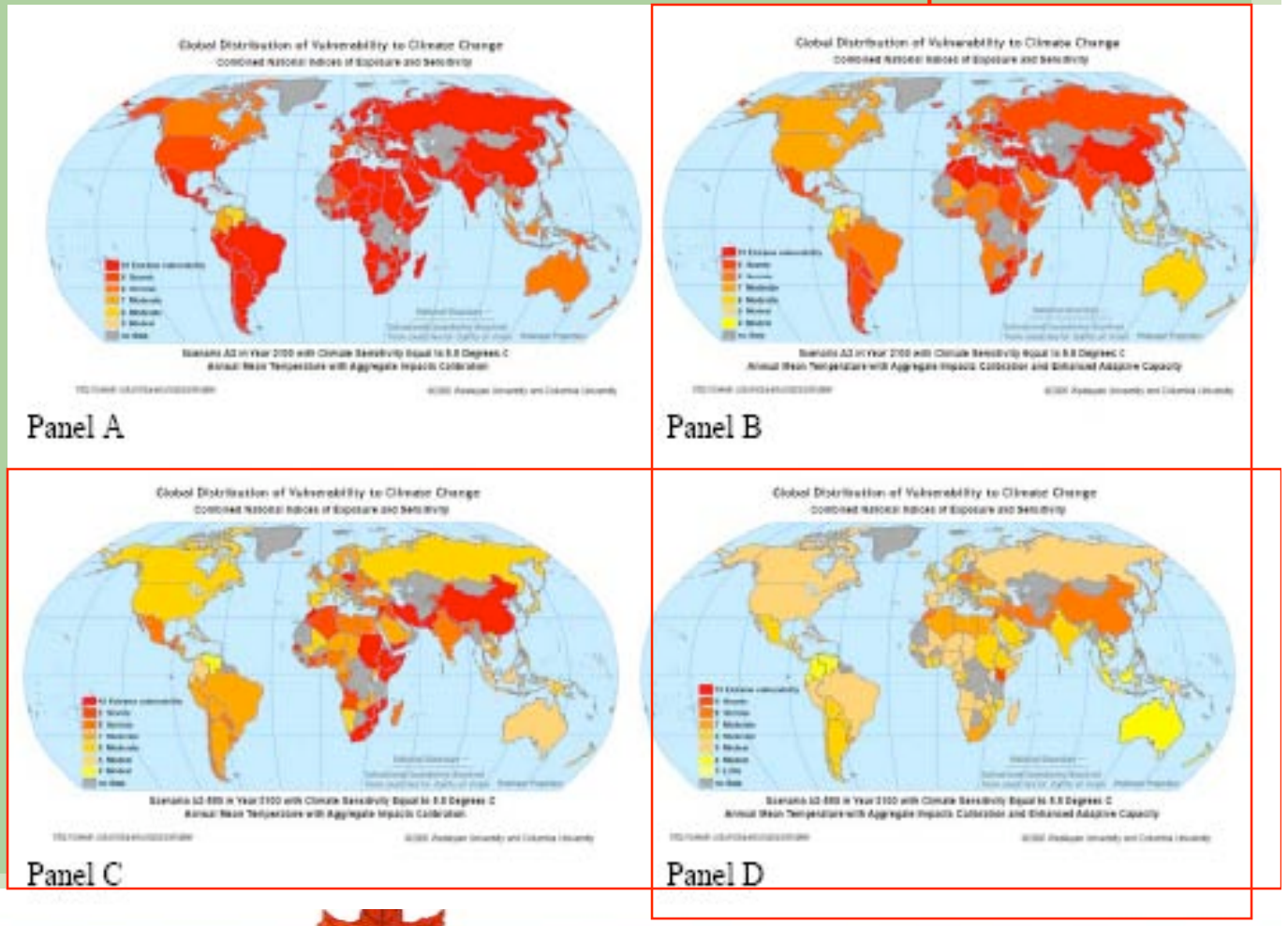


Vulnerability in 2100, A2 scenario, with and without explicit climate change mitigation (550 ppm stabilization) and enhanced adaptive capacity (Yohe, 2006)

Panel A = no response;
Panel B = enhanced Adaptive Capacity
Panel C = 550 ppm;
Panel D = 550 ppm + enhanced Adaptive Capacity

adaptation

mitigation



Adaptation Strategies

Protection

- Sea walls

Accommodation

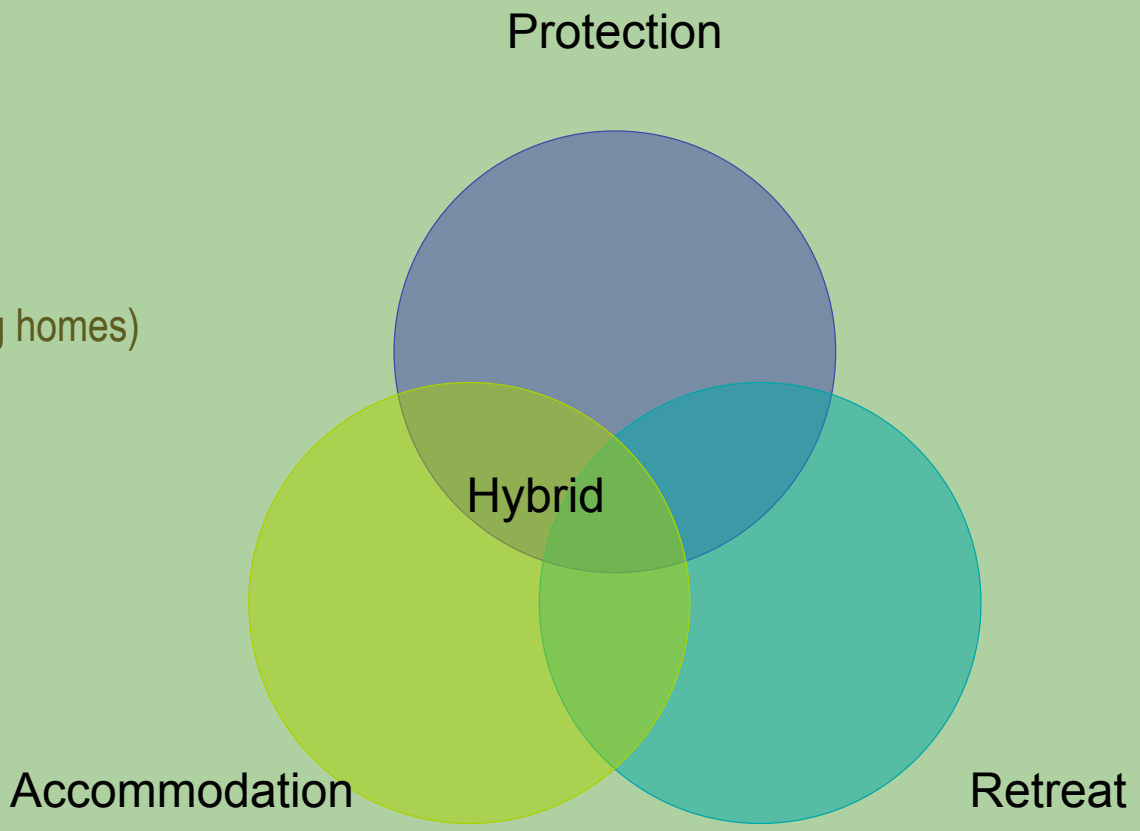
- Redesign structures (e.g. raising homes)
- Implement zoning
- Dune rehabilitation
- Wetland renewal

Retreat

- Relocate

Hybrid

- Combination of one or more



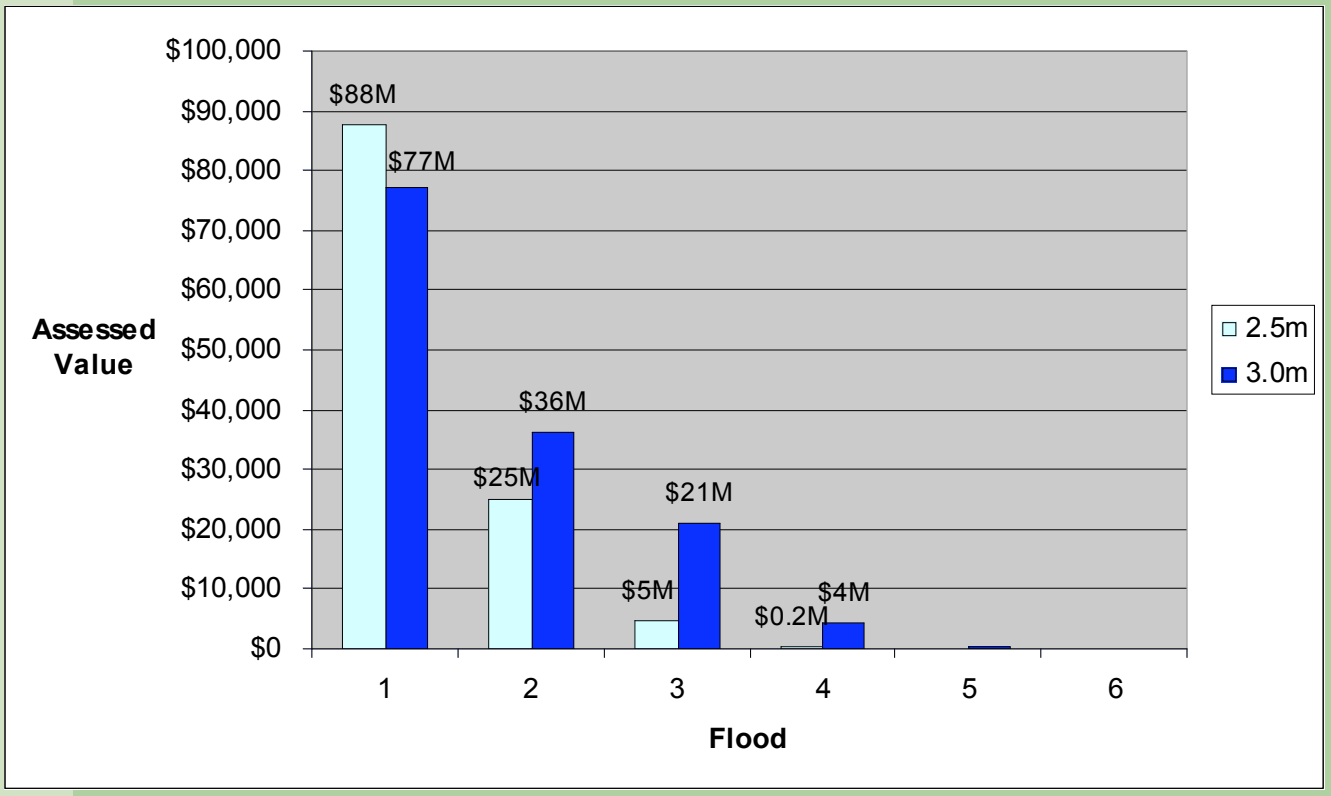
Assessment of Climate Change Impacts and Adaptation Responses

Decision making considerations:

- Impact assessment
  - *Quantify the cost of climate change impacts*
- Adaptation Options
  - *Evaluate the costs of the options*
  - *Evaluate the effectiveness and feasibility of options*
  - *Consult with stakeholders*
- Complete an analysis of the benefits and costs of each adaptation option
  - *Benefits are the avoided damages*
  - *Costs are the full realm of costs associated with implementing each adaptation option.*
  - *Use a tool to compare and decide the most effective and efficient adaptation option to implement*

Impacts to Property and Infrastructure in Coastal Areas – Shediac Bay Case Study

Total existing properties at risk of flooding



No. of Properties At Risk

Flood Class	2.5M	3.0M
1 (< 0.5m)	1,188	1,050
2 (>0.5-1.0m)	345	561
3 (>1.0-1.5m)	87	294
4 (>1.5-2.0m)	14	79
5 (>2.0m-2.5m)	4	14
6 (>2.5m)	1	5
Total	1,639	2,003

Total assessed value of properties at risk under a 2.5M water level is approx. $118M
Total assessed value of properties at risk under a 3.0M water level is approx. $139M