

Provincial Climate Change Projections

Government of Newfoundland and Labrador
October 2018

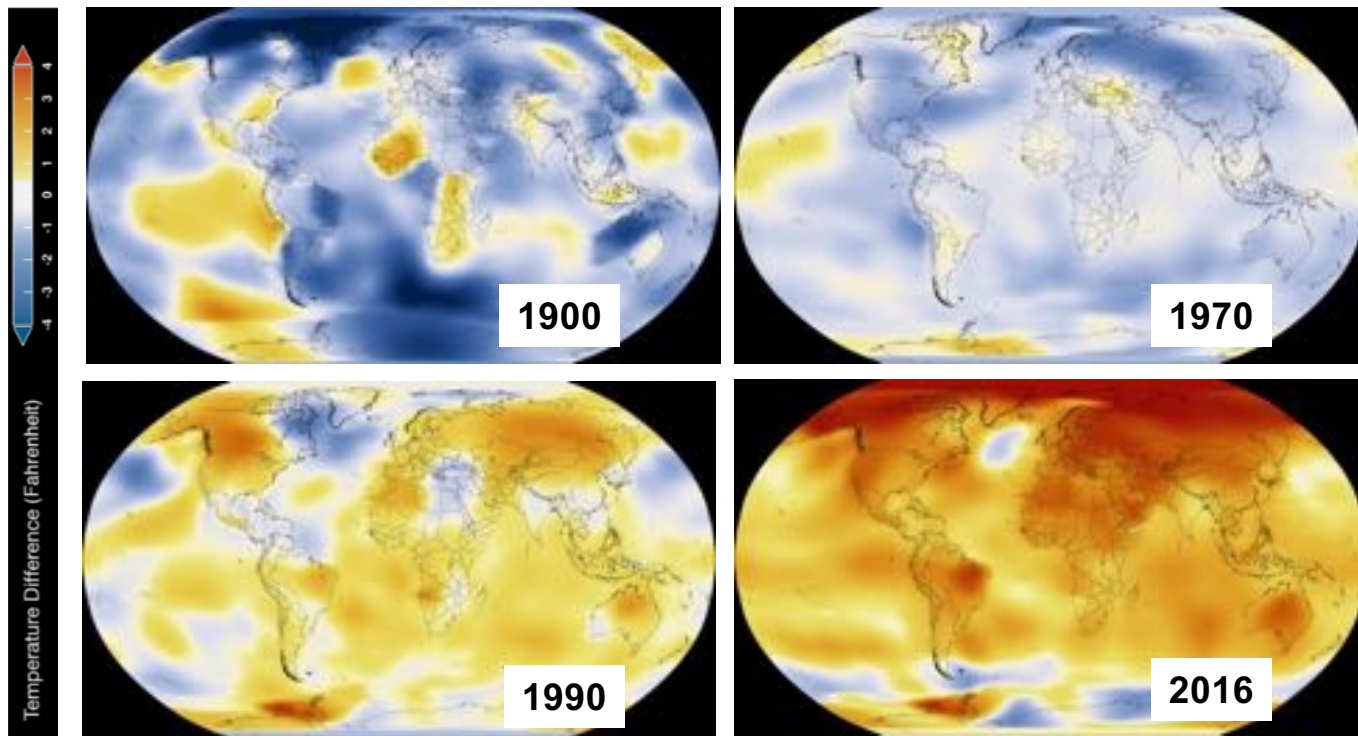
Overview

- **Introduction**
- **Key Findings: Temperature and Precipitation**
- **Key Findings: Extreme Precipitation Events**
- **Risks, Impacts and Vulnerabilities**

Global emperatures are rising

2016 was the warmest year on record

2017 was the third warmest year on record



Why do this work?

- **Climate change is happening**
 - **Significant over time**
 - **Will impact different stakeholders in different ways**
- **Governments, municipalities and industry need information to plan**
- **Better information ➡ better planning and decision making**
- **Better decisions ➡ reduced risks and costs**

Key Areas for municipalities - examples

- **Water management**
 - **Water supply – quantity, quality**
 - **Flooding – rivers, floodplains, drainage**

- **Built infrastructure (roads, buildings, trails, wharves, etc.)**
 - **Flooding**
 - **Sea level rise and coastal erosion**

- **Services provided**
 - **Seasonal and emergency services**
 - **Support for economic development**

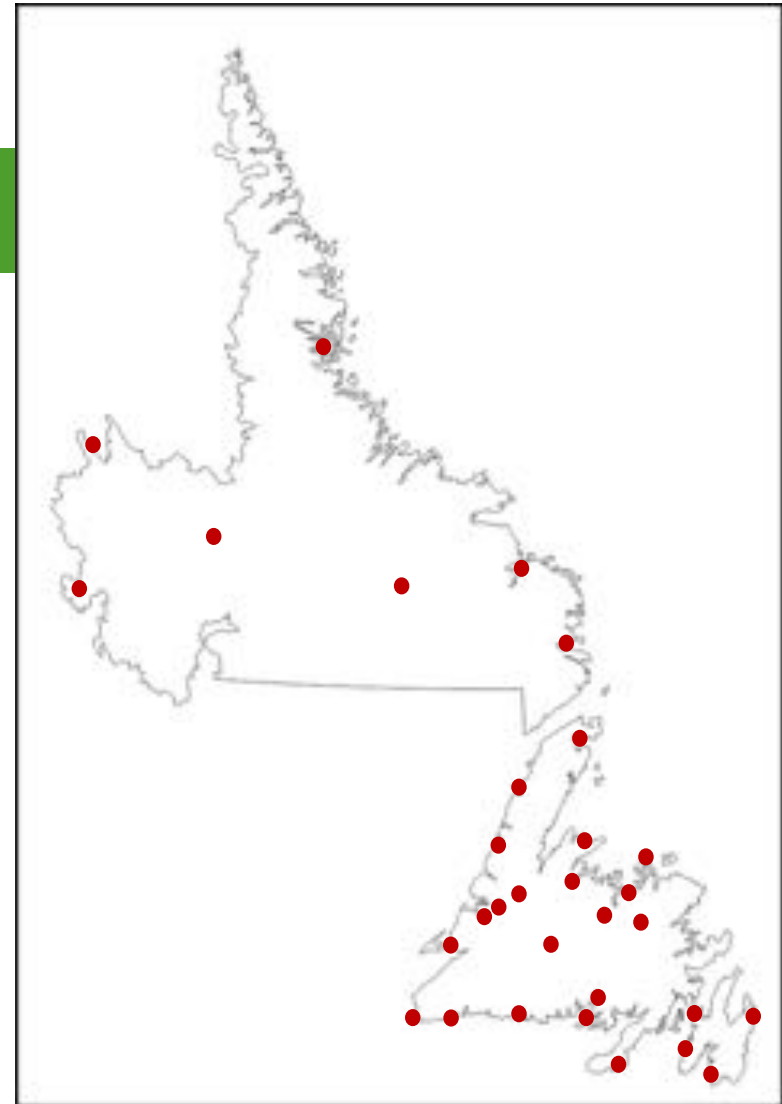
Overview of 2018 Study

- **Used most recent global climate models**
- **Used most recent historical data available**
- **Comprehensive approach – ensemble approach using 12 simulations**
- **More locations modeled than in previous work**
- **More detailed extreme precipitation projections**

Location Overview

**29 weather stations assessed for
temperature and precipitation**

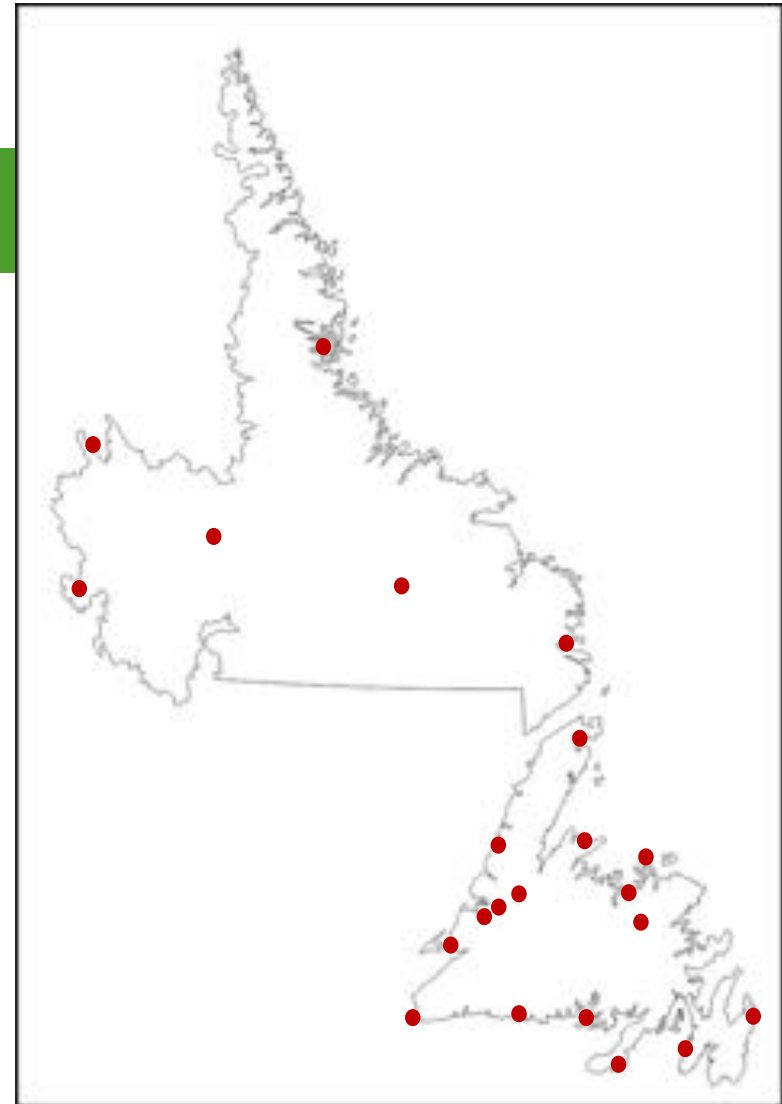
Newfoundland		Labrador and Quebec
Argentia	LaScie	Cartwright
Bay d'Espoir	North Harbour	Churchill Falls
Burgeo	Plum Point	Goose Bay
Comfort Cove	Port aux Basques	Mary's Harbour
Corner Brook	Springdale	Nain
Daniel's Harbour	St. Alban's	Wabush Lake
Deer Lake	St. Anthony	Schefferville (Quebec)
Exploit's Dam	St. John's	
Gander	St. Lawrence	
Grand Falls	Stephenville	
Isle aux Morts	Twillingate	



Extreme precipitation overview

Projections for 20 locations

Locations		Intervals	Return periods
Argentia	Churchill Falls	5 minutes	2 years
Burgeo	Goose Bay	10 minutes	5 years
Comfort Cove	Mary's Harbour	15 minutes	10 years
Daniel's Harbour	Nain	30 minutes	25 years
Deer Lake	Schefferville (QC)	1 hour	50 years
Gander	Wabush Lake	2 hours	100 years
LaScie		6 hours	
Port aux Basques		12 hours	
St. Alban's		24 hours	
St. Anthony			
Stephenville			
St. John's			
St. Lawrence			
Twillingate			



Key Messages

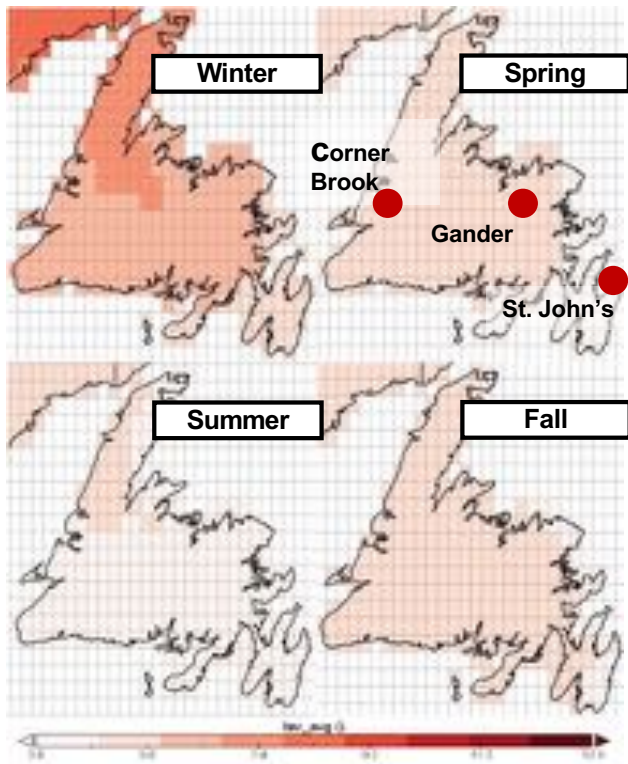
- **Bigger and more comprehensive study than 2013**
 - **More locations, more recent data and improved modeling**
- **Key messages from 2013 remain**
 - **Warmer, wetter, stormier**
- **Underlying trends becoming more pronounced – examples:**
 - **Shorter and milder winters**
 - **More warmth in soils and waters**
 - **More intense precipitation events**



Key Findings:
Temperature and Precipitation

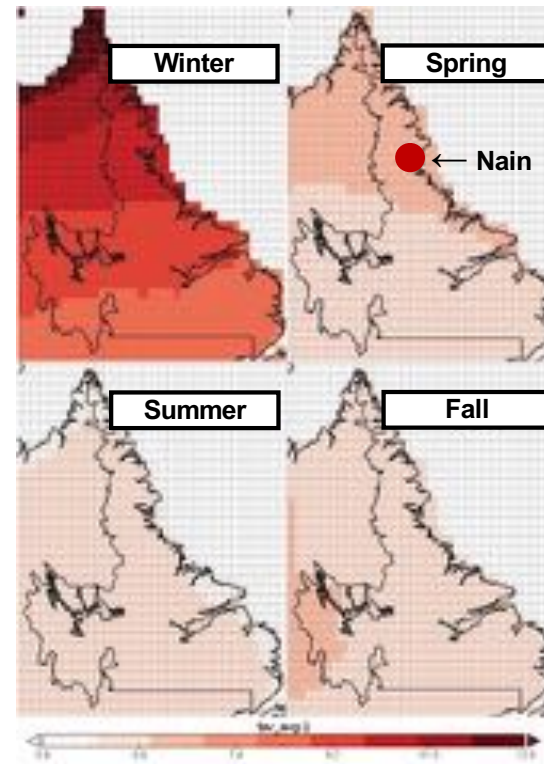
Temperatures are projected to rise

Change in average daily temperature – end of 20th century to mid 21st century



Select locations

- Nain**
+7.3°C in winter
+2.6°C in summer
- Corner Brook**
+4.4°C in winter
+3.0°C in summer
- Gander**
+4.3°C in winter
+2.6°C in summer
- St. John's**
+3.4°C in winter
+2.4°C in summer



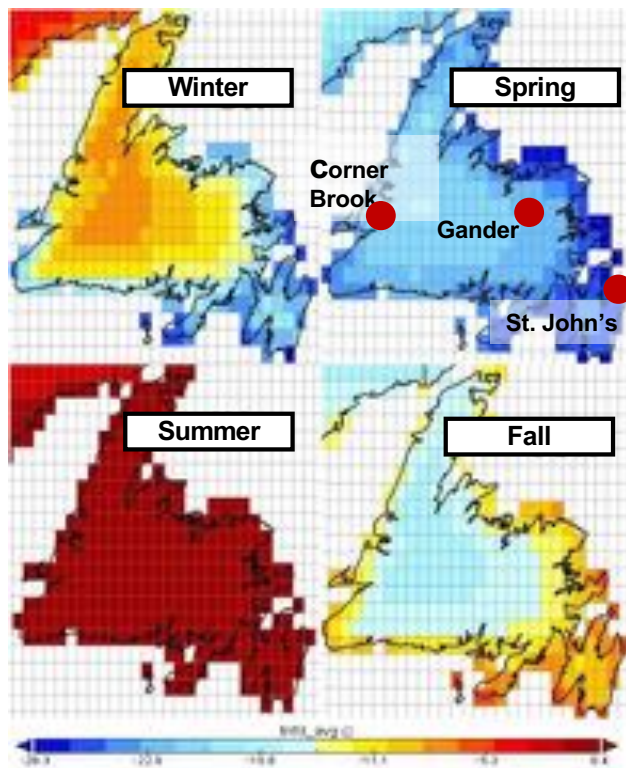
Temperatures are projected to rise

Change in average daily temperature – end of 20th century to end of 21st century

Select locations – Change in °C				
	By mid century		By late century	
	Summer	Winter	Summer	Winter
St. John's	+2.4	+3.4	+4.2	+5.3
Gander	+2.6	+4.0	+4.7	+6.6
Corner Brook	+3.0	+4.4	+5.0	+6.8
St. Anthony	+2.7	+5.0	+4.7	+7.5
Goose Bay	+2.9	+6.0	+5.0	+9.2
Nain	+2.6	+7.3	+4.8	+10.9

Number of days with frost is projected to decline

Change in number of frost days – end of 20th century to mid 21st century



Select locations

Nain

-21.6 Days in Fall
 -11.4 Days in Spring

Corner Brook

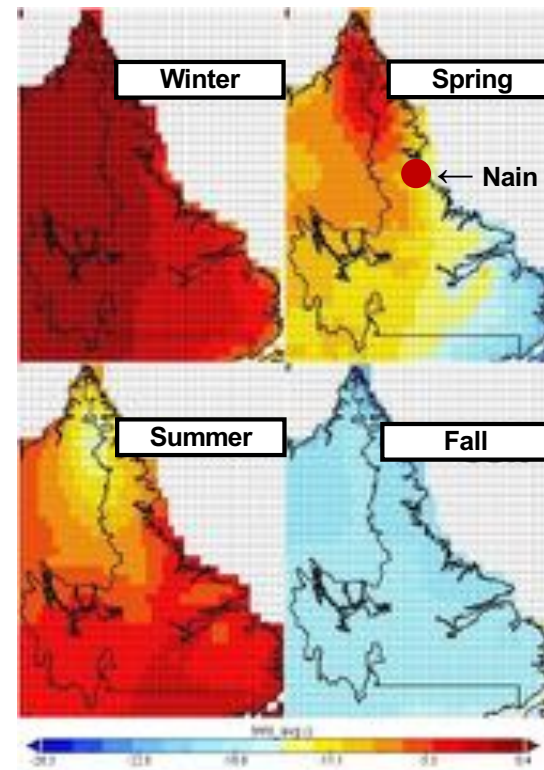
-12.8 Days in Fall
 -20.3 Days in Spring

Gander

-14.2 Days in Fall
 -24.9 Days in Spring

St. John's

-12.8 Days in Fall
 -19.3 Days in Spring



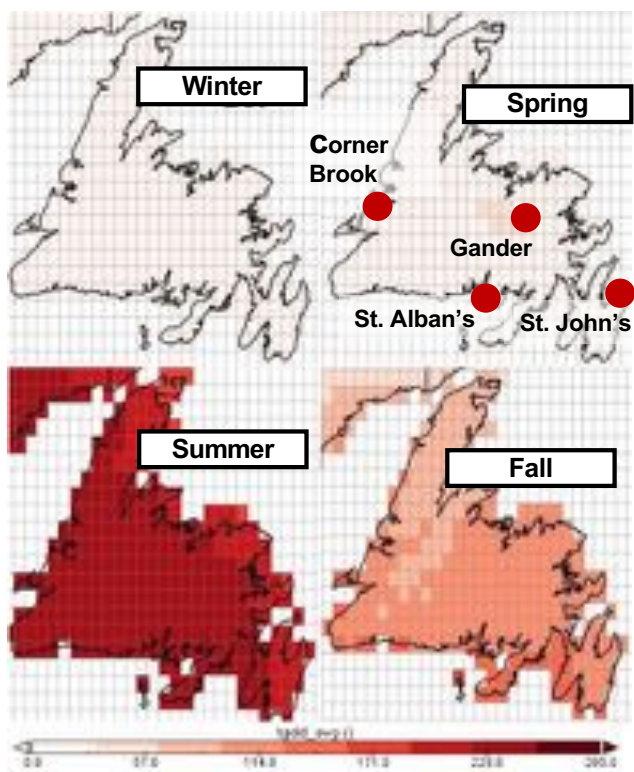
Number of days with frost is projected to decline

Change in number of frost days – end of 20th century to end of 21st century

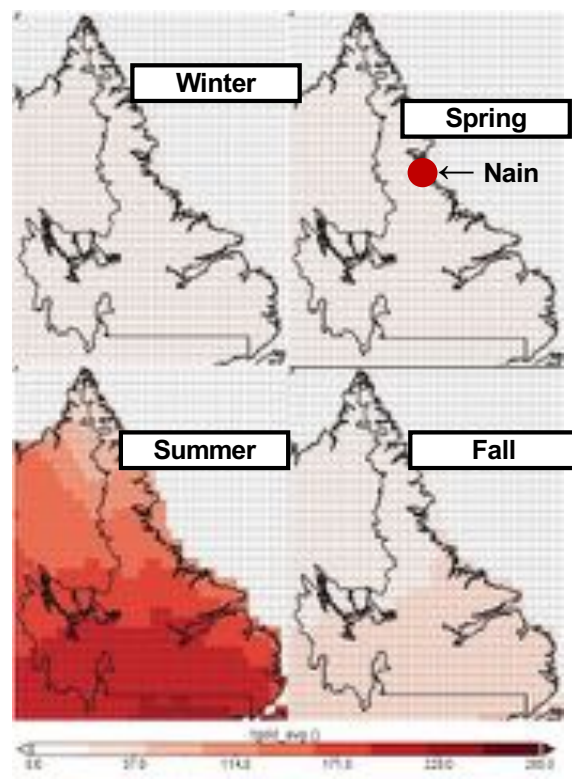
Select locations – Change in number of frost days				
	By mid century		By late century	
	Fall	Spring	Fall	Spring
St. John's	-12.76	-19.26	-15.80	-35.61
Gander	-14.21	-24.89	-19.75	-38.36
Corner Brook	-12.84	-20.26	-16.73	-31.39
St. Anthony	-15.88	-20.72	-22.07	-35.09
Goose Bay	-19.50	-15.56	-28.19	-26.90
Nain	-21.57	-11.41	-30.77	-24.07

Warmer temperatures mean more warmth in soils/waters

Change in growing degree days – end of 20th century to mid 21st century



- Select locations
- Nain**
+126% annually
 - Corner Brook**
+64% annually
 - Gander**
+59% annually
 - St. John's**
+61% annually
 - St. Alban's**
+75% annually



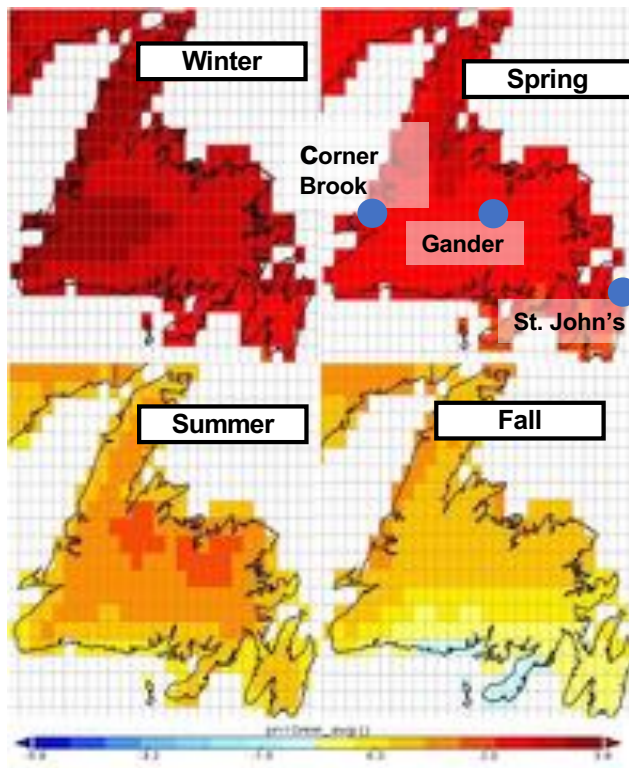
Warmer temperatures mean more warmth in soils/waters

Change in growing degree days – end of 20th century to end of 21st century

Select locations – Percent change		
	By mid century	By late century
	Annual	Annual
St. John's	61%	117%
Gander	59%	111%
St. Alban's	75%	137%
Corner Brook	64%	115%
St. Anthony	78%	149%
Goose Bay	69%	130%
Nain	126%	294%

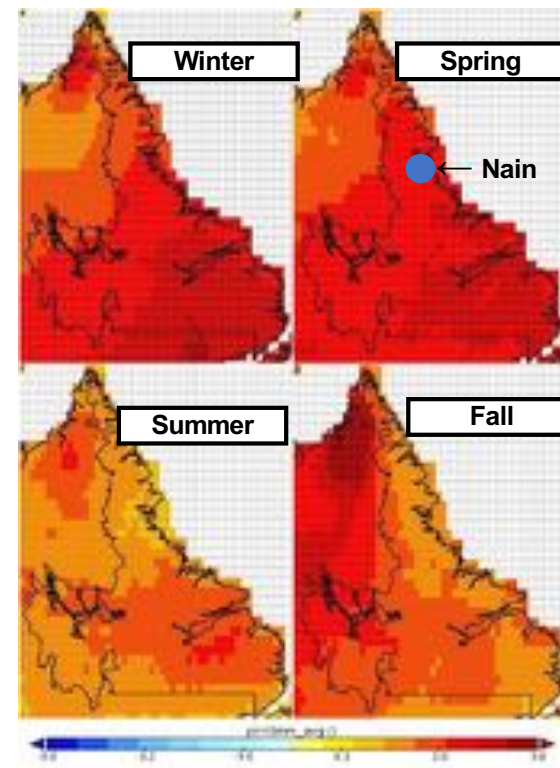
Number of high precipitation days is expected to increase (2)

Change in precipitation day with 10+ mm – end of 20th century to mid 21st century



Select locations

- Nain**
+4.3 days annually
- Corner Brook**
+6.8 days annually
- Gander**
+5.4 days annually
- St. John's**
+2.6 days annually

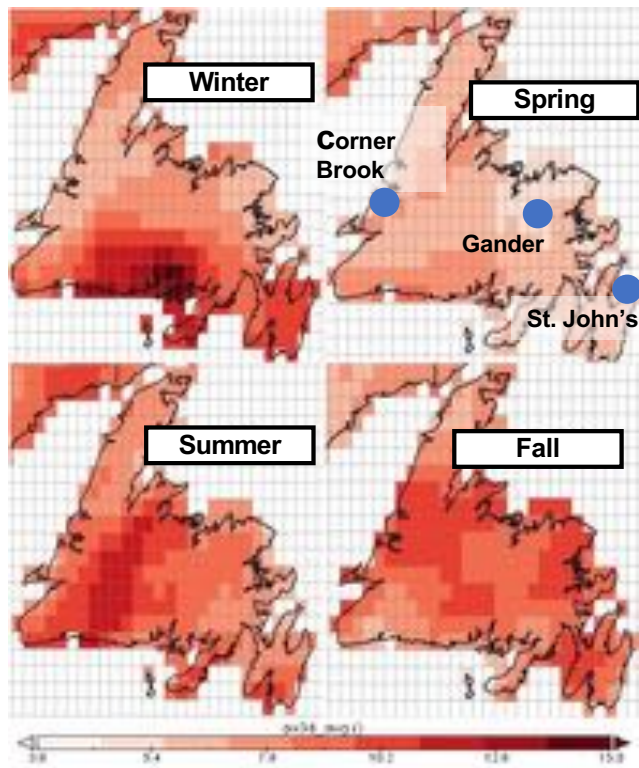


Number of high precipitation days is expected to increase (3)
Change in precipitation day with 10+ mm – end of 20th century to end of 21st century

Select locations – Number of days		
	By mid century	By late century
	Annual	Annual
St. John's	2.6	2.2
Gander	5.4	8.1
Corner Brook	6.8	8.7
St. Anthony	8.2	10.9
Goose Bay	6.0	8.7
Nain	4.3	5.7

Maximum 3-day precipitation is expected to increase (2)

Change in precipitation – end of 20th century to mid 21st century



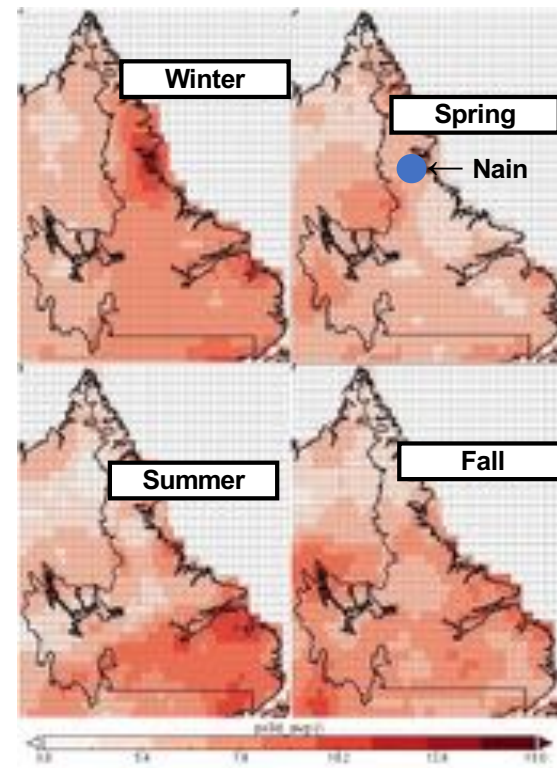
Select locations

Nain
+31.5% in Fall

Corner Brook
+22.4% in Fall

Gander
+19.3% in Fall

St. John's
+19.3% in Fall



Maximum 3-day precipitation is expected to increase (3)

Change in precipitation – end of 20th century to end of 21st century

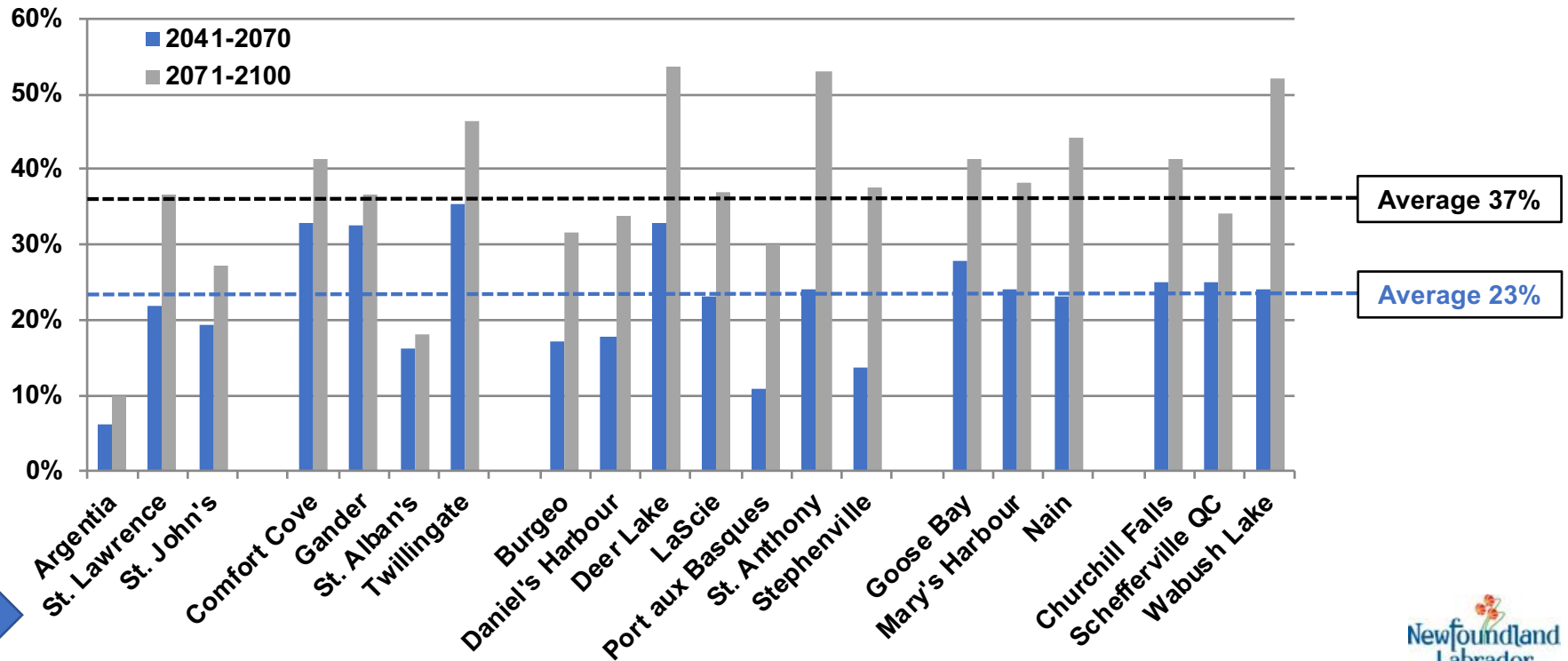
Select locations – Percent change		
	By mid century	By late century
	Fall	Fall
St. John's	19.3%	23.1%
Gander	19.3%	26.9%
Corner Brook	22.4%	32.6%
St. Anthony	33.6%	47.1%
Goose Bay	21.7%	27.9%
Nain	31.5%	34.1%



Key Findings:
Extreme Precipitation Events

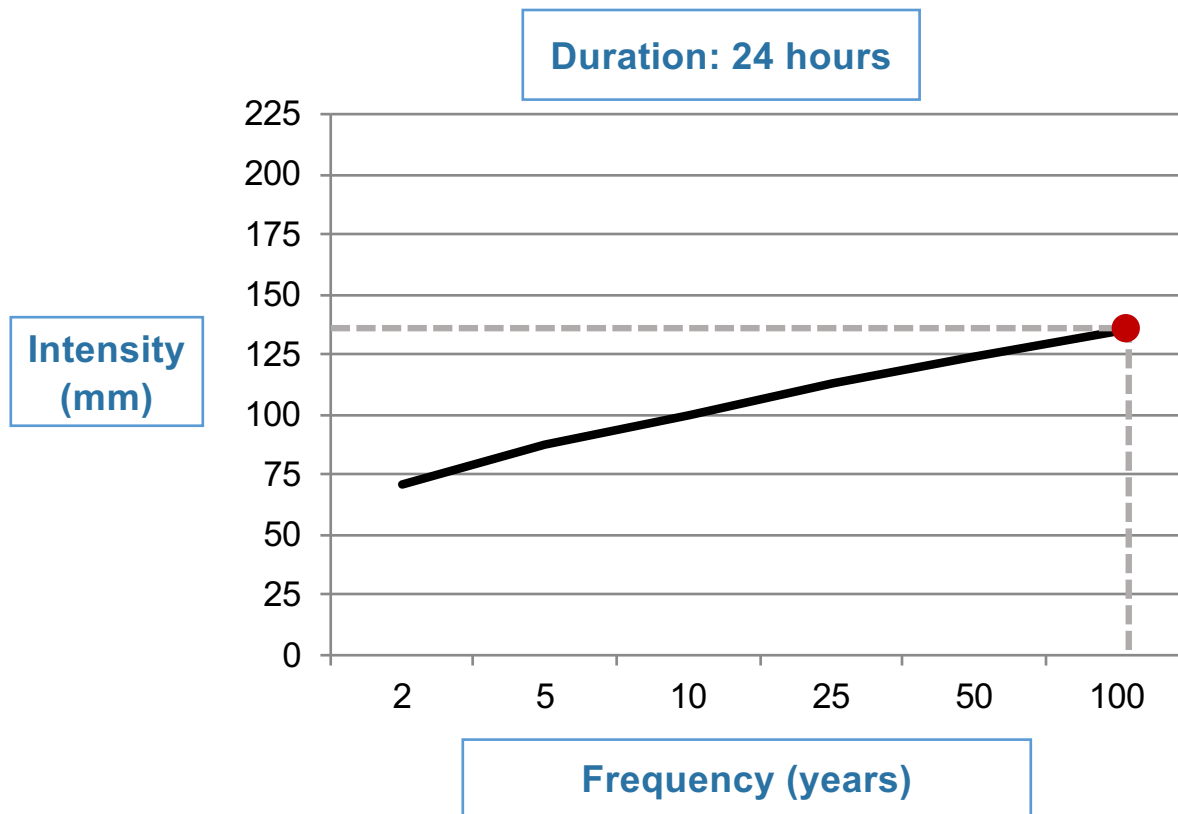
Extreme precipitation events are projected to intensify

Average of all intervals and all durations relative to end of 20th century



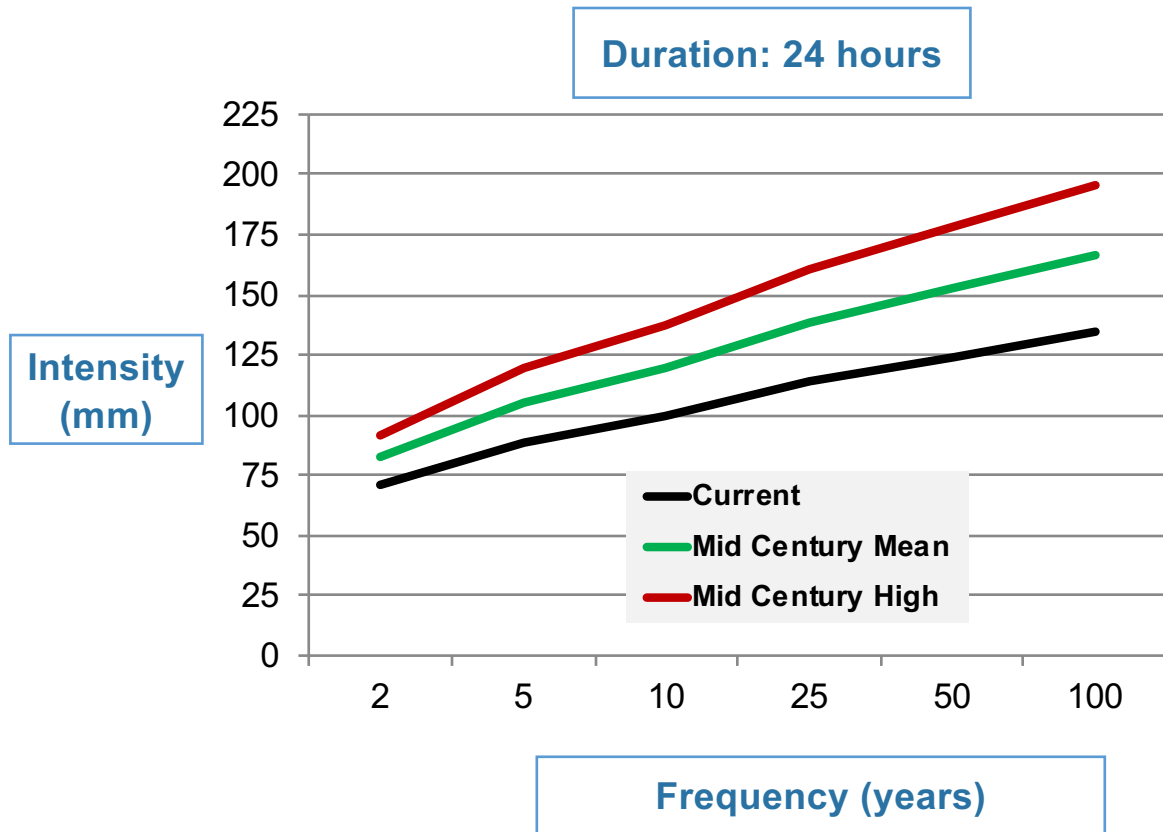
Extreme Precipitation: St. Lawrence

Current IDF projections



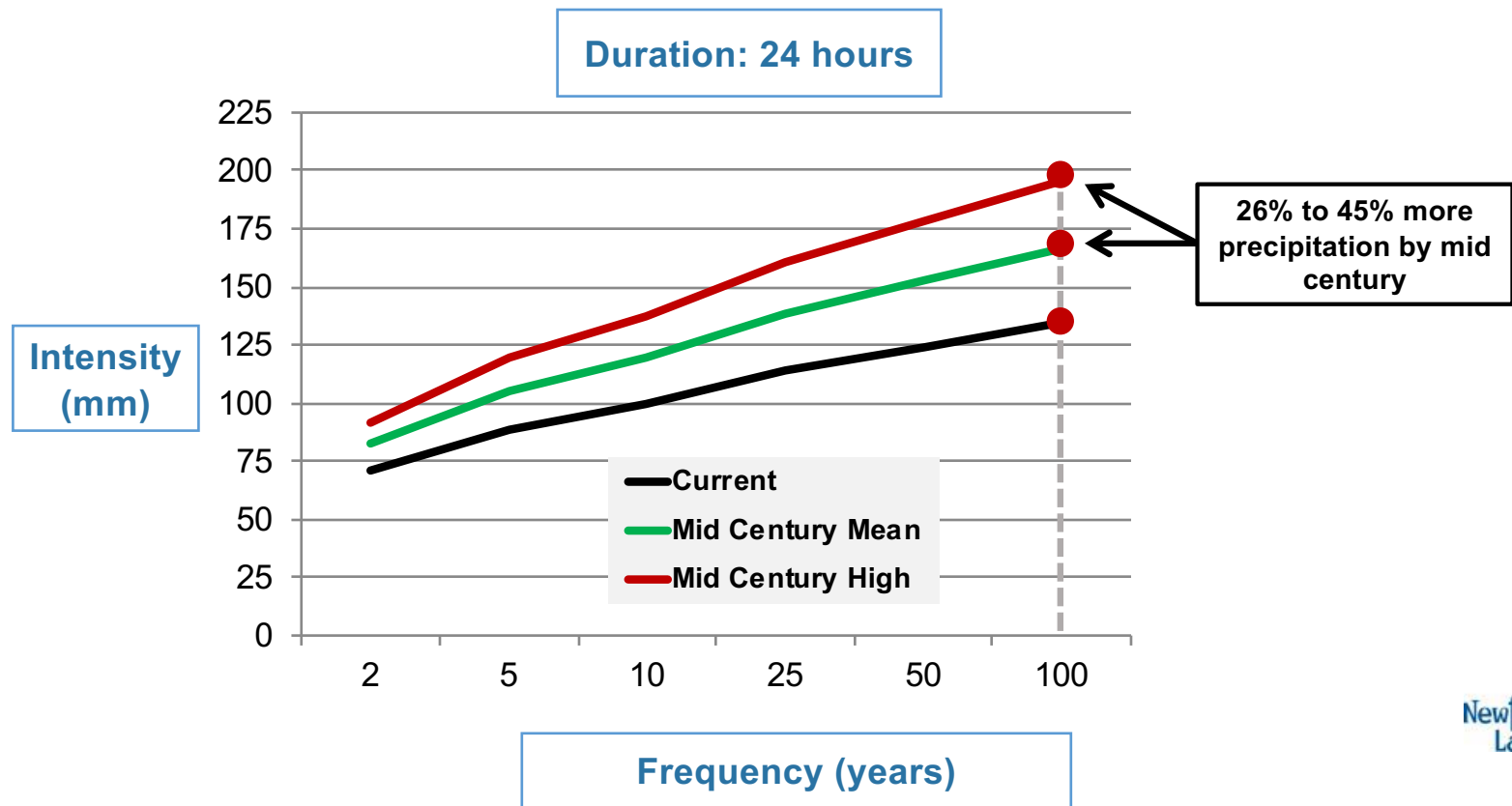
Extreme Precipitation: St. Lawrence

Current and mid-21st century IDF projections



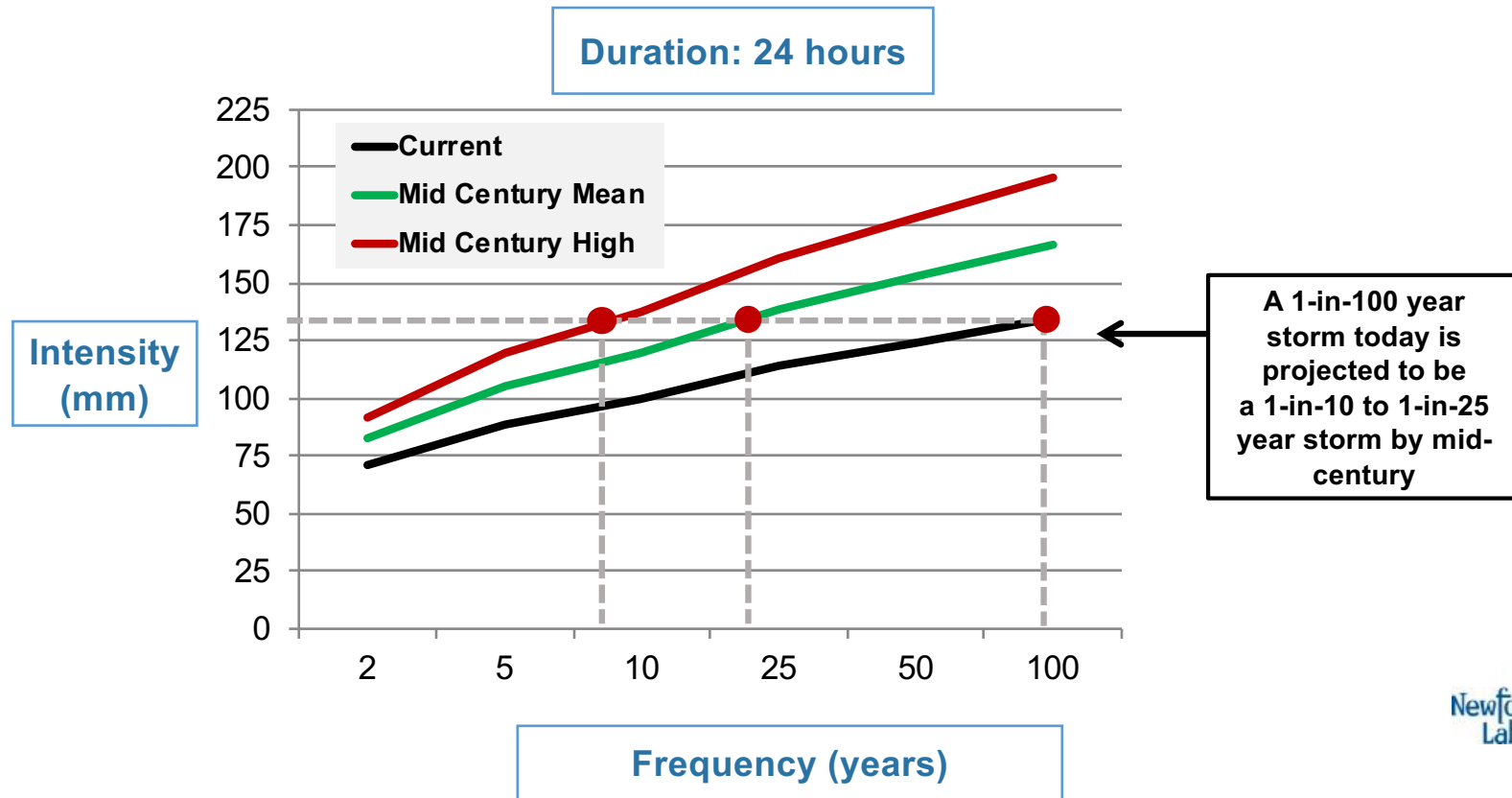
Extreme Precipitation: St. Lawrence

Current and mid-21st century IDF projections



Extreme Precipitation: St. Lawrence

Current and mid-21st century IDF projections





Risks, Impacts and Vulnerabilities

Potential municipal risks, impacts and vulnerabilities

- **Oceans and coasts**
 - **Sea level rise, coastal erosion and saltwater intrusion**
 - **Changing sea ice conditions**

- **Private and public infrastructure damage**
 - **Overland flooding**





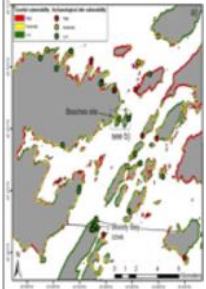



- **Invasive species and pests, including human health vulnerabilities**

- **Shifts in economic activity**
 - **e.g., timing of big game hunting, length of ski-dooing season**

Potential Opportunities

- **Economic opportunities**
 - **More productive agriculture, forestry, fisheries and aquaculture industries**
 - **Longer summer tourism seasons**
- **Technology development opportunities**
 - **Sea ice monitoring**

Tools and Resources

IDF Curves	Flood Risk Maps	Flood Alert System	7 Steps Tool	CARRA	Smart ICE	Coastal Erosion Monitoring	Climate Data Information Portal
All IDF curves updated (and have projections)	Climate change flood risk maps	Seasonal Hurricane Flood Alert System	Community Vulnerability Assessment Tool	Coastal Archaeological Resources Risk Assessment Tool	Sea ice monitoring system for coastal communities	~120 monitoring sites	Historical data (80 weather stations)
							

<http://www.exec.gov.nl.ca/exec/occ/climate-data/index.html>

Key Messages

- **Warmer, wetter, stormier**
- **Shorter and milder winters**
- **More warmth in soils and waters**
- **More intense precipitation events**