

# Predicting and Alerting for Coastal Flooding (PACF) Project

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Prediction Services Directorate

Environment and Climate Change Canada, Meteorological Service of Canada

Sept 15, 2022



Environment and Climate Change Canada's 50<sup>th</sup> anniversary  
50<sup>e</sup> anniversaire d'Environnement et Changement climatique Canada

Meteorological Service of Canada's 150<sup>th</sup> anniversary  
150<sup>e</sup> anniversaire du Service météorologique du Canada



Environment and  
Climate Change Canada

Environnement et  
Changement climatique Canada

Canada

# Acknowledgements

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## ECCC/MSC

- Mathieu Rioux
- Lisa Vitol
- Bobby Sekhon
- Juliana Paul

## Storm Surge BC

- Dr. Scott Tinis

## PEI

- Hope Parnham
- Andrew Clark
- Andrew Ing
- Catherine Kennedy
- Erin Taylor
- Peter Nishimura
- Tanya Mullally

## EMBC

- Nicole Norris
- Ian Cunnings
- Ken Meeks
- Jeff Owens
- John Forrest
- Hannah Swift
- Corey Anderson

# Objectives

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- Socialize PACF initiative and what it entails.
- Identify who within your organizations can work with us to understand risk along the coast and develop appropriate thresholds for Coastal Flooding Warnings for the PACF project.
  - Do you have a planning, public works (roads, water/wastewater infrastructure) or engineering department?
  - Does your municipality or Indigenous Community have data that one can use to determine the elevations of their lowest lying infrastructure (roads, buildings)?

# Feedback / Engagement

- We're using Menti to collect contact info and details at your municipal or indigenous community levels, you can also post any comments there anonymously.
  - **Please visit menti at <https://www.menti.com/5icnz5j52r> or use the QR code bottom left**
  - For an example of our mapping, use the QR code on bottom right.



**Menti survey**  
(point your phone camera  
at this graphic)

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**ECCC's Interactive  
Coastal Flooding Map**

## KEY POINTS

- The Federal Government is investing in a national coastal flooding project, covering all Canadian coasts.
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# What is Coastal Flooding?

- **Coastal flooding** occurs when dry and low-lying land is submerged by water.
- **What causes coastal flooding?** (that we are trying to forecast):

### **Shorter time scales** (daily to seasonally)

- Tides
- Atmospheric wind and pressure
- Seiche (harbours)
- Waves (set-up / run-up)

### **Longer time scales** (years to decades)

- De-glaciation
- Thermal expansion
- Post-glacial rebound of earth's mantle



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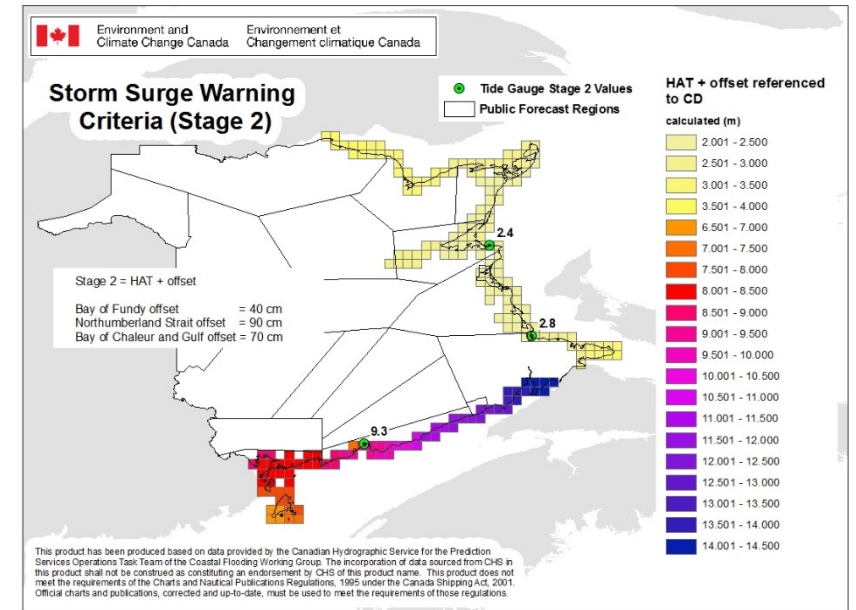
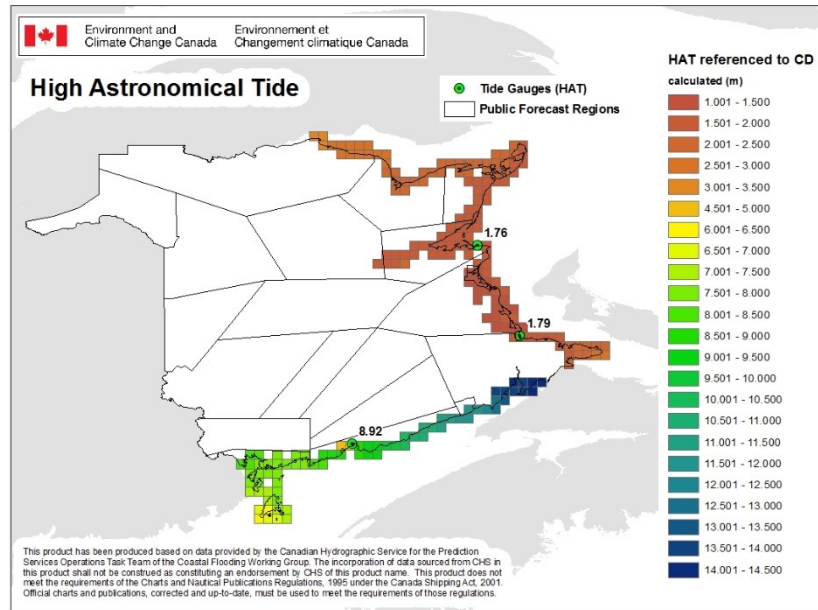
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# What is Coastal Flooding?



## Astronomic Tides

- When does knowing tides become more important?
- Inversely dependent on tide range.
  - People live closer to the high tide mark where the tidal range is larger.



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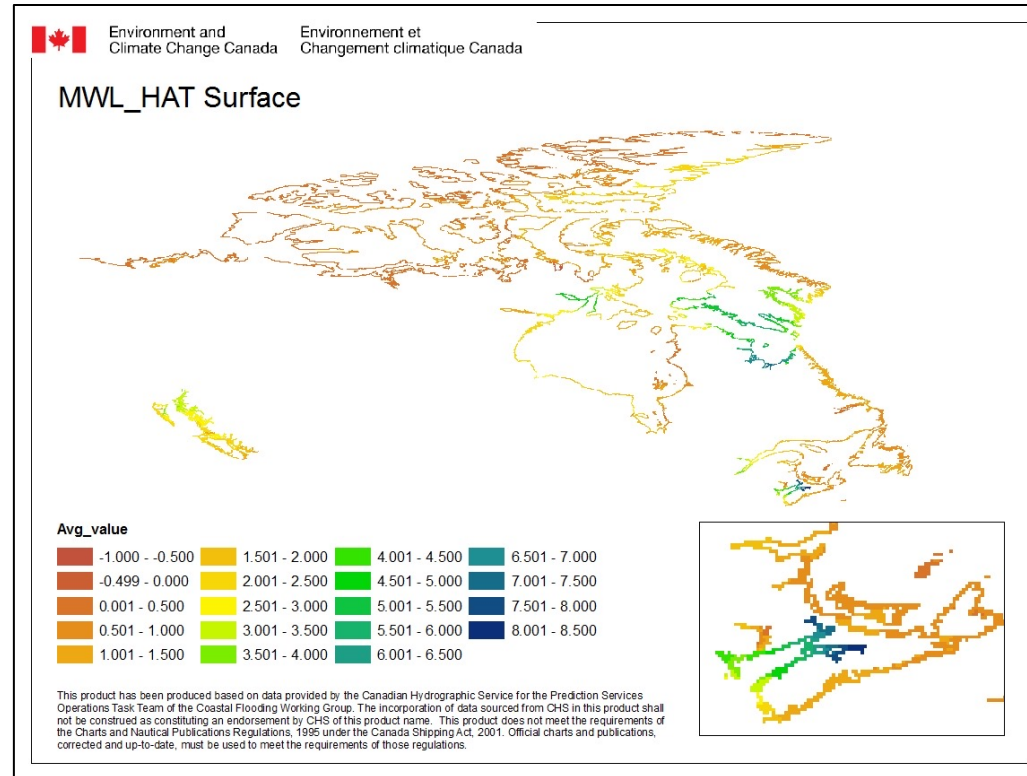
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# What is Coastal Flooding?



## Astronomic Tides

- When does knowing tides become more important?
- Like parts of Atlantic Canada, BC has some very large tides.



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# What is Coastal Flooding?



## Astronomic Tides

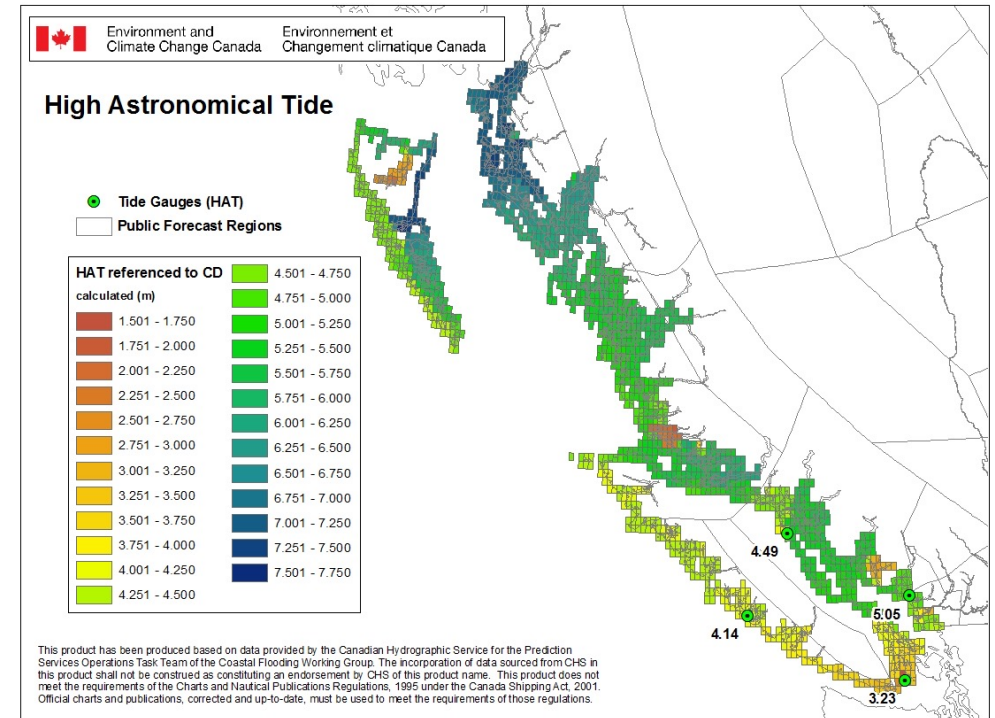
- In short.. A few days around the King Tide

### King Tide

- Perigee, perihelion and Spring Tides
- Perihelion: Closest distance between the earth and Sun
- Occur 1-2 times a year.

### Perigean Spring Tides

- Perigee: Closest distance between Earth and Moon
- Spring tides + Moon at perigee. (3-4/year)





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# Increasing Coastal Flooding Risk

- Coastal flooding due to **wave action, storm surge and astronomical tide are a common occurrence along Canada's marine coasts, Atlantic and Pacific coasts, the western Arctic and the Great Lakes and St. Lawrence.**
- **Increased impacts of coastal flooding are expected in the future** due to global sea-level rise in combination with the increased intensity of extreme weather.

***Storm Surge:*** An abnormal rise of water generated by a storm. Strong winds in a tropical cyclone or a severe mid-latitude storm are their primary cause. However, ocean bottom topography, tides, waves and freshwater input from rivers affect the water level rise during a storm surge.

- UN World Meteorological Organization

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## What are some Impacts due to coastal flooding?

- Damage to infrastructure or property
  - Nuisance flooding of private property in low lying areas
  - Widespread disruption of infrastructure (railways, utilities, hospitals)
- Disruption to travel
  - Potentially wet nearshore roads
  - Several sections of roads and escape routes could be closed.
- Danger to life
  - Higher than usual water levels, waves or stronger currents
  - Large scale evacuation may be required



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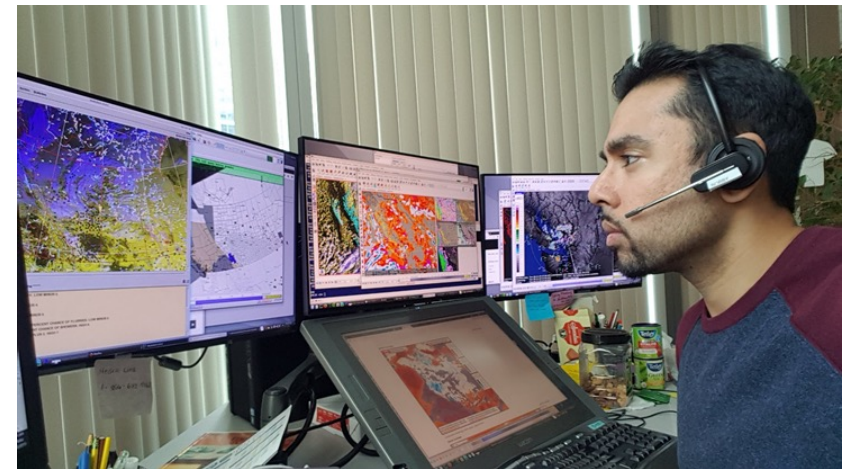


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## ECCC's current contribution to coastal flooding information provided to municipalities

- The Meteorological Service of Canada (MSC is within ECCC) is constantly monitoring the weather (24/7 365 Days).
  - Meteorologists (MT's) in the Pacific and Yukon Storm Prediction Centre (PYSPC)
  - Warning Preparedness Meteorologists (WPMs) working closely with Emergency Management BC (EMBC)



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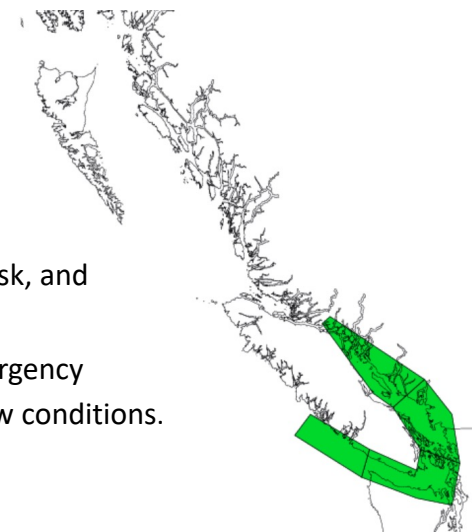


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## ECCC's current contribution to coastal flooding information provided to municipalities

- If MTs and WPMs see that there could be a Storm with the potential to create coastal flooding they will reach out to:
  - Storm Surge BC (Dr. Scott Tinis)
    - Operates the BC Storm Surge Forecast Model.
    - [BC Storm Surge Forecasting Program - Home \(stormsurgebc.ca\)](https://stormsurgebc.ca)
  - River Forecast Center
    - Analyses snow pack, assesses seasonal water supply and flood risk, and predicts flows in British Columbia's rivers and streams.
    - Produces a range of bulletins, maps and warnings to inform emergency managers and the public about current and upcoming streamflow conditions.



MSC

sees that there could be a Storm that might have the potential to create coastal flooding

Storm Surge BC & River Forecast Center

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## ECCC's current contribution to coastal flooding information provided to municipalities

- Through consultation, if the MT's and WPMs, Storm Surge BC (Dr. Scott Tinis) and the River Forecast Center think that there is risk of coastal flooding they will:
  - Co-develop an impact statement
  - The WPMs will reach out to **Emergency Management BC (EMBC)** to inform them that they will be sending a **Weather Notification**.
    - Weather Notification: A briefing presentation sent by email to:
      - EMBC
      - Federal and Provincial government departments
      - Municipal, local and Indigenous level of government
      - Industry Partners

MSC

sees that there could be a Storm that might have the potential to create coastal flooding

Inform EMBC of the **Weather Notification**.

Storm Surge BC & River Forecast Center

Assess flooding potential

Co-develop impact statements

EMBC

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# ECCC's current contribution to coastal flooding information provided to municipalities

- Emergency Management British Columbia (EMBC) is the coordinating agency for the provincial government's emergency management activities.
- The Emergency Management function in EMBC is organized into six regions, plus a Headquarters located near Victoria.
- Each region has a Regional Office and **Provincial Regional Emergency Operation Centre** or **PREOC** available for immediate activation in response to an emergency or disaster.



## MSC

sees that there could be a Storm that might have the potential to create coastal flooding

Inform EMBC of the **Weather Notification**.

## Storm Surge BC & River Forecast Center

Assess flooding potential

Co-develop impact statements

## EMBC

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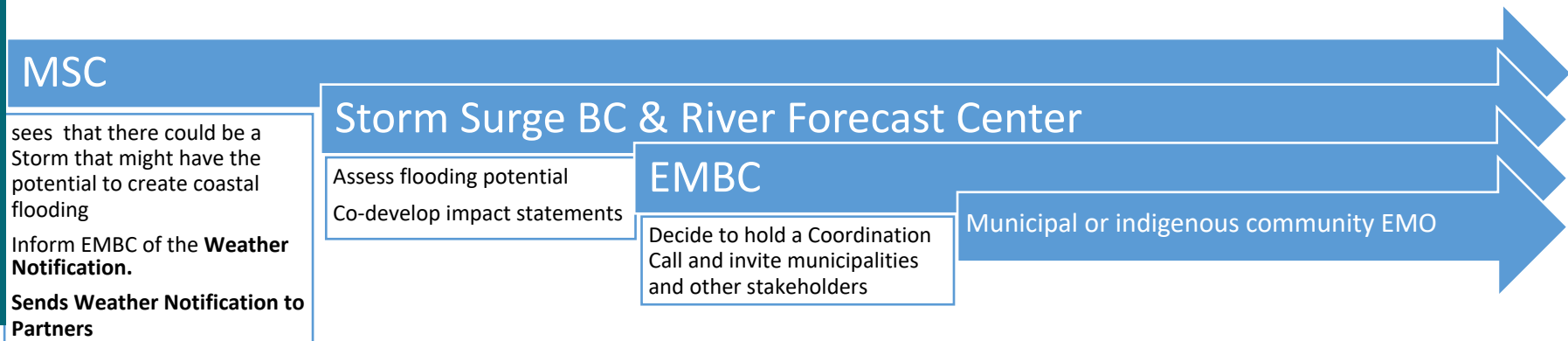


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## ECCC's current contribution to coastal flooding information provided to municipalities

- EMBC can now coordinate a “Pre-awareness call” with all of the stakeholders, including:
  - Federal and Provincial government departments
  - Municipal, local and Indigenous level of government
  - Industry Partners
- This gives the stakeholders the opportunity to get clarification as well as ask questions from the Subject Matter Experts (SMEs) from MSC, Storm Surge BC and the River Forecast Center.



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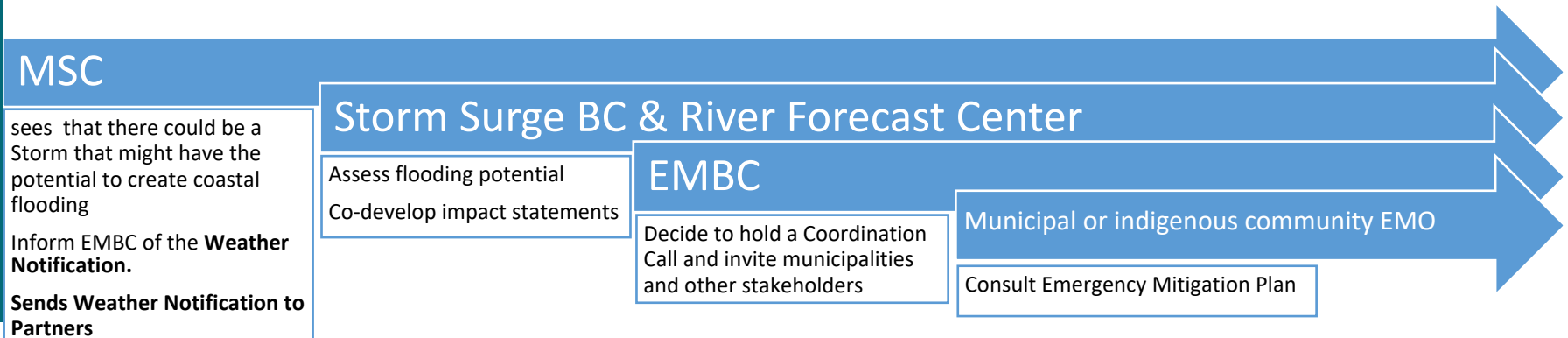


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## ECCC's current contribution to coastal flooding information provided to municipalities

- Municipalities receive coastal flooding products and services 3 ways.
  - Weather Notification from MSC
  - “Pre-awareness call” coordinated by EMBC
  - [BC Storm Surge Forecasting Program \(stormsurgebc.ca\)](https://stormsurgebc.ca)
- Municipal or indigenous community EMO
- EMO's can now consult their Emergency Mitigation Plans



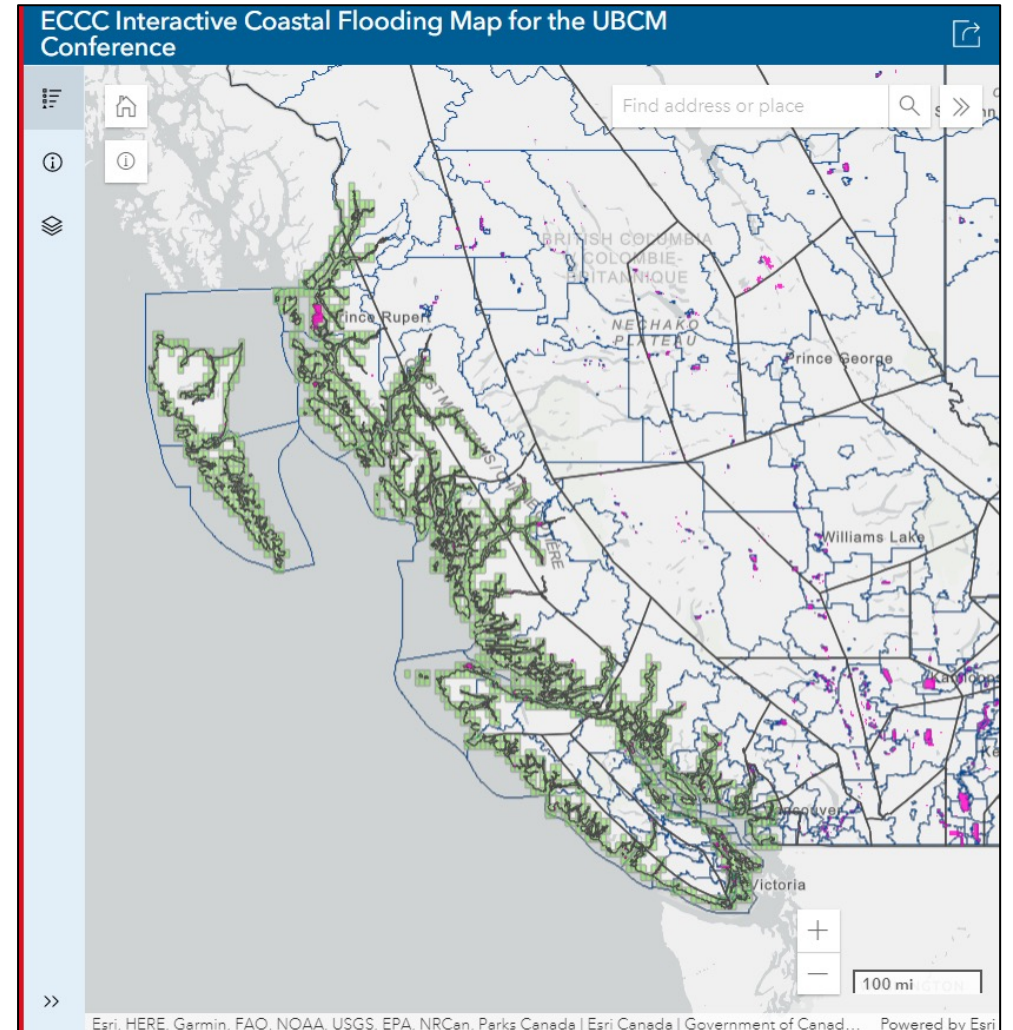


# As we begin to talk about PACF itself...

- Please feel free to follow the link from this QR code to see an example of our current Coastal Flooding Map.
- The Next slides will describe where PACF aims to build on existing capabilities and provide additional coastal flooding information.



**ECCC's Interactive  
Coastal Flooding Map**



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# The PACF Initiative and its Goals



Building on previous investments, this initiative aims to offer:



**Comprehensive Service**  
National coastal coverage

**Investment in an integrated, national system of comprehensive coastal flooding prediction and alerting.**



**Enhanced Technology**  
Integrated, innovative approaches

**Introduction of new modelling and visualisation innovations,** including provision of uncertainties associated with water level predictions above and beyond storm surge forecasts currently produced for the Atlantic Coast.



**Improved Capacities**  
Enhanced public safety

**Develop the capability to deliver 24/7 coastal water level alerting options** to the Pacific and Arctic marine waters, as well as the Great Lakes and St. Lawrence.



**Integrated Approach**  
Engaging partners to collaboratively deliver services

**Engage Provincial and Territorial partners to formalize roles and responsibilities, and identify any collaborative opportunities,** specifically in identifying vulnerable areas and alerting thresholds

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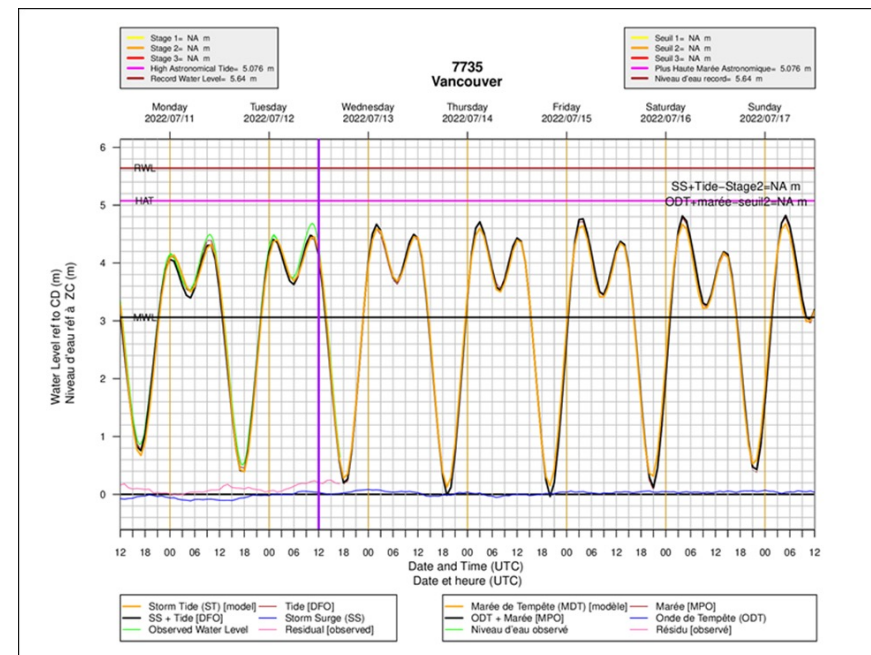


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- ECCC has developed several models to predict coastal flooding for all of Canada's coasts, including BC.
- Through engagement with ECCC's stakeholders we are developing the capacity to disseminate coastal flooding warnings by the spring of 2024.
- Fall and Winter of 2022/2023: stakeholders have the opportunity to evaluate the 2 models,

# How ECCC plans to provide coastal flooding information to municipalities **in the near future, through PACF**



## MSC

sees that there could be Storm that might have the potential to create coastal flooding

Inform EMBC of the **Weather Notification**.

**Sends Weather Notification to Partners**

## Storm Surge BC & River Forecast Center

Assess flooding potential  
Co-develop impact statements

## EMBC

Decide to hold a Coordination Call and invite municipalities and other stakeholders

Municipal or indigenous community EMO

Consult Emergency Mitigation Plan

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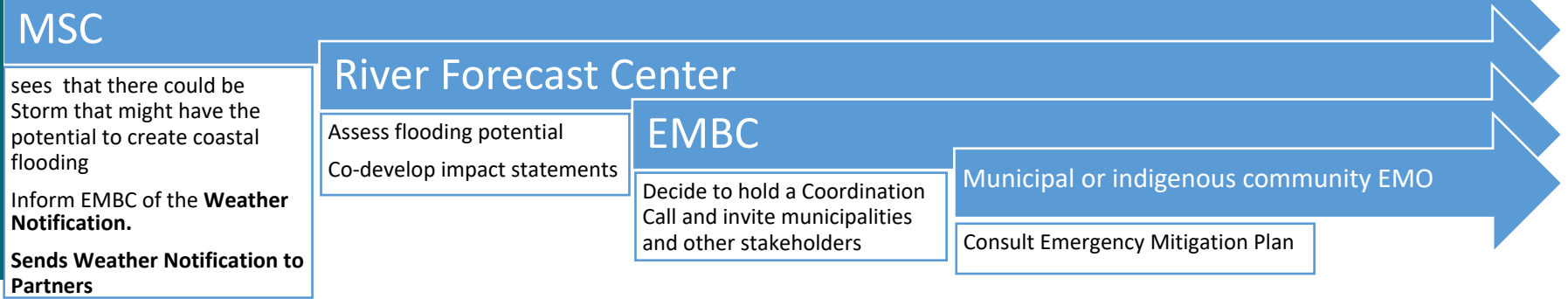
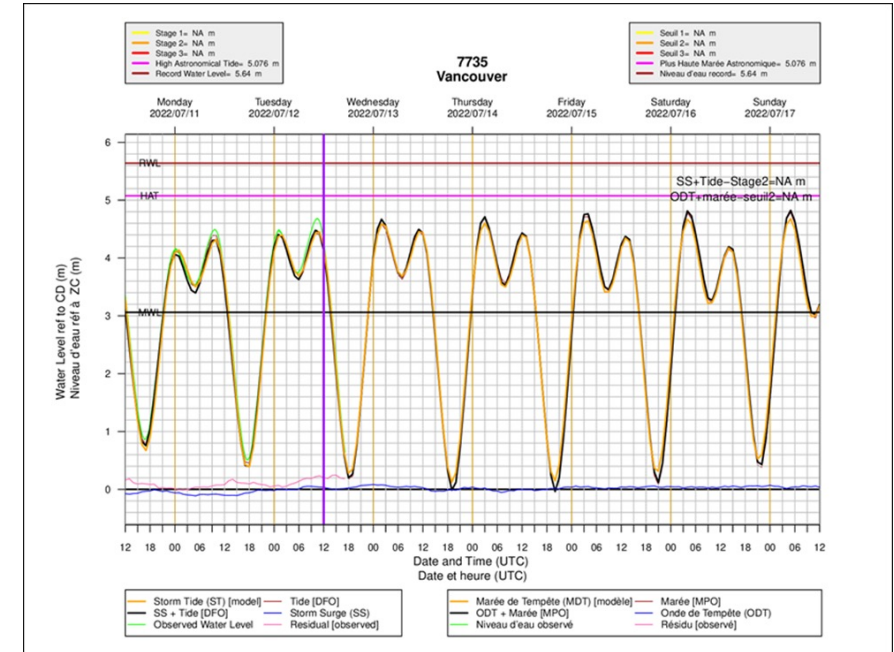


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- as we transition from Storm Surge BC guidance to an ECCC guidance.

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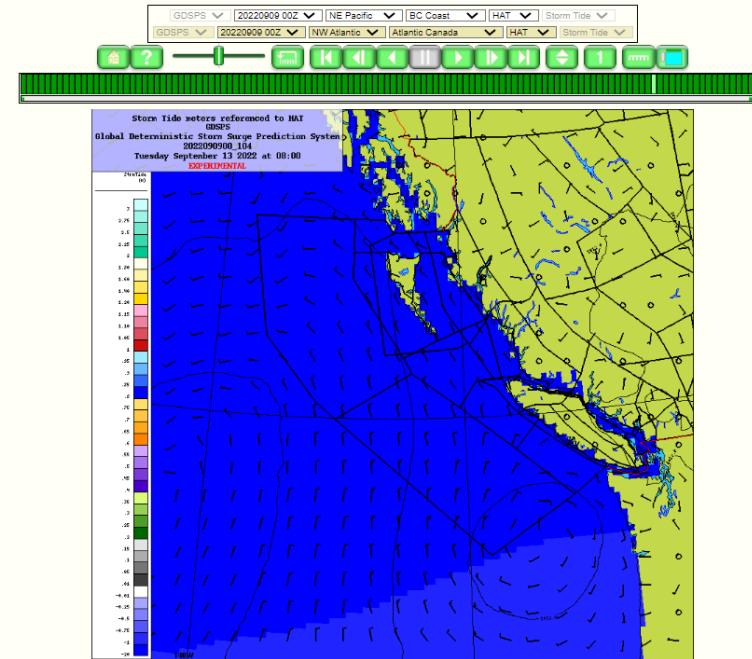


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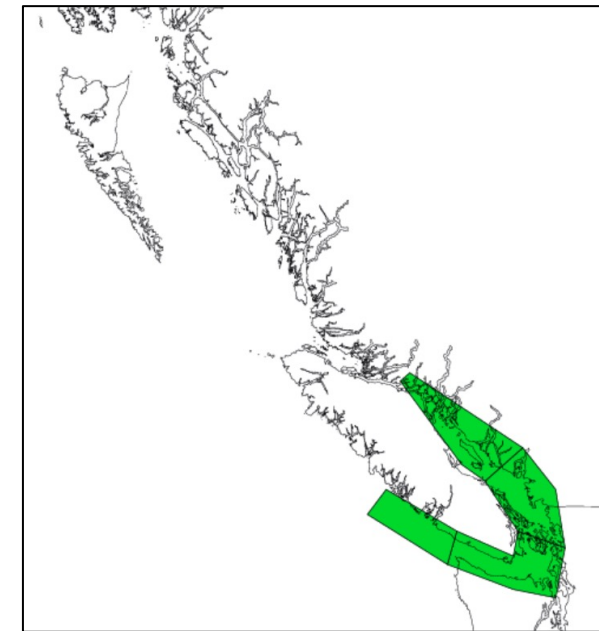
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# How ECCC plans to provide coastal flooding information to municipalities **in the near future, through PACF**

- Fall and Winter of 2022/2023 stakeholders have the opportunity to evaluate the 2 models,
- as we transition from Storm Surge BC guidance to an ECCC guidance.



[https://hpx.collab.science.gc.ca/~smar001/storm\\_surge](https://hpx.collab.science.gc.ca/~smar001/storm_surge)



<https://stormsurgebc.ca/index.html>

## KEY POINTS

- The Federal Government is investing in a national coastal flooding project, covering all Canadian coasts.
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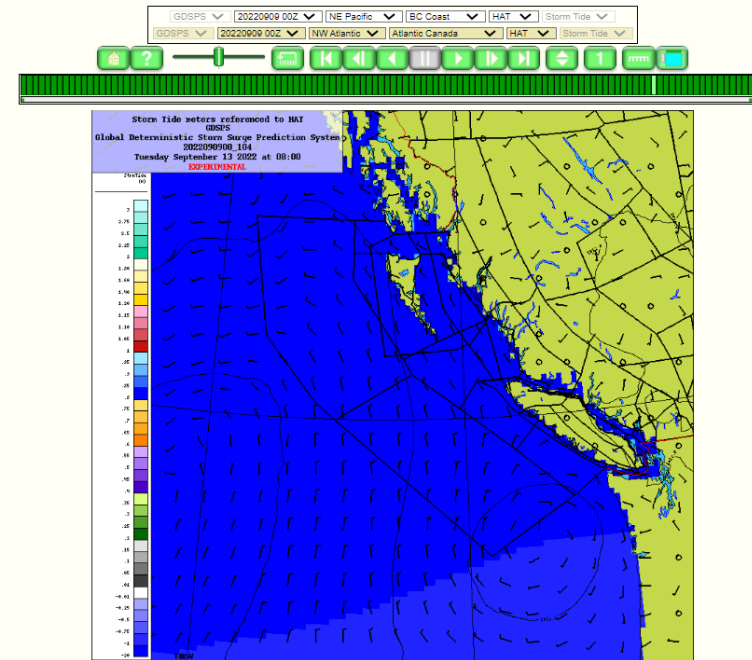


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# How ECCC plans to provide coastal flooding information to municipalities **in the near future, through PACF**

- In addition to:
  - Weather Notifications from MSC
  - “Pre-awareness call” coordinated by EMBC
- In the near future Coastal Flooding Warnings can be available to the General Public similarly to other MSC Warnings (Snowfall, Heat, Gale, etc)

**Heavy Rain for South Coast**  
Event Duration: Sat April 2 to Mon April 4, 2022

Product for Emergency Managers - may vary from the Public Forecast  
Produit pour les gestionnaires d'urgence - peut varier par rapport aux prévisions publiques

Likelihood	Risk			
	High	Moderate	Low	Very low
High	✓	✓		
Moderate			✓	✓
Low				✓
Very low				✓

**Impacts**  
(Stream Vulnerability & Exposure)

- In discussion with RFC, heavy rainfall may lead to elevated stream levels and localized flooding especially in smaller streams, and low-lying areas.
- Strong gusty winds may lead to local power outages.

April 1, 2022

12:54 88%

Yarmouth, NS

NOW HOURLY 7 DAY RADAR

15°C  
Mist  
Wind: SW 34 km/h  
Gusts: 50 km/h

Past 24 Hour Conditions

1 p.m.	2 p.m.	3 p.m.
14°C	15°C	15°C

Sunrise - Sunset: 5:46 - 20:58 ADT

Air quality →

Coastal flooding Risk **Medium Risk** →

Humidity: 97%

Dew point: 15°C

Government of Canada / Gouvernement du Canada

Search: Canada.ca

Home | Environment and natural resources

Access: City | Weather Topics

Last updated: 5:14 PM NDT Mon 29 Aug 2022

**Weather Information**

Welcome to the prototype for the weather website! Data displayed on this site is not live.

Use this site to access weather information as layers on an interactive map. Alternatively, there is a [table](#) available below to view all active alerts. Learn more [about the layers](#).

**Layers**

- Alerts
- Radar
- Basemap

Weather Alerts for Canada

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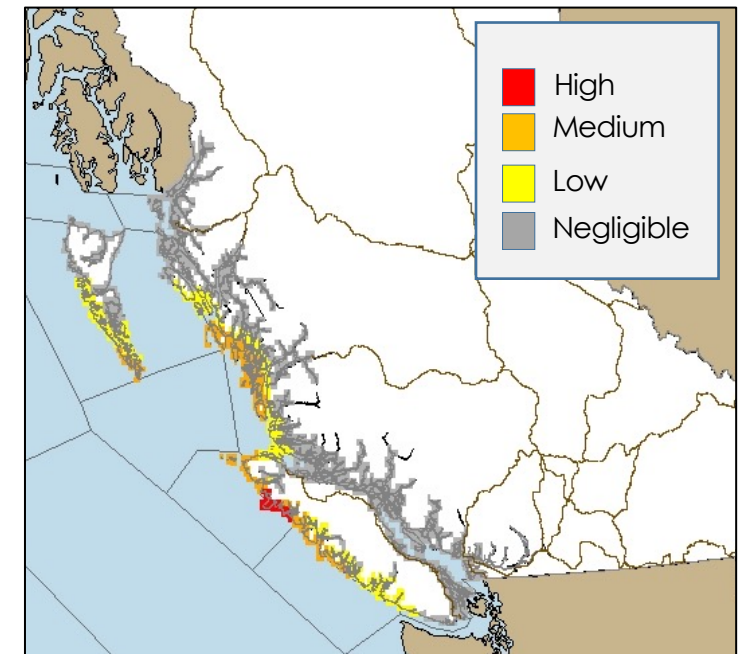
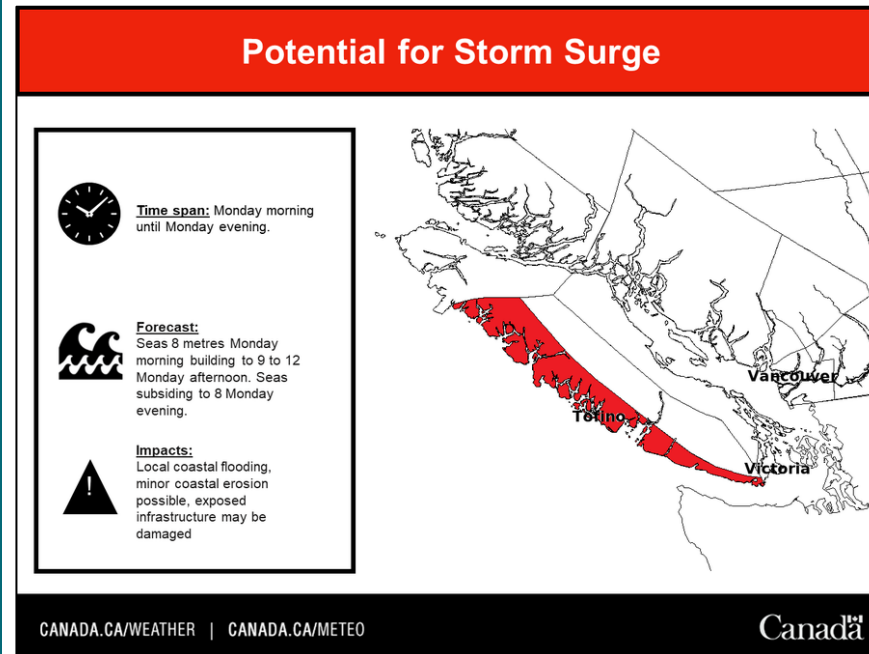
# How ECCC plans to provide coastal flooding information to municipalities **in the near future, through PACF**



Using grid and provincial data for warning criteria development

- Coastal Flooding Risk Products can also be available to the public and be integrated into current tweets and Weather Notifications.
- Similar to the Air Quality Health Index

Example Resolution For Daily Risk Products







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# Example: Current PACF Engagement with PEI



Contours (0.1 m)



Intersect



Shapefiles: Buildings, Roads

Result:

- A point is created for every intersection between contour lines and buildings/roads.
- The elevation (contour value) of each point is recorded in the new point files.

OBJECTID	Shape	FID_Grid_72_contour_01m	Id	Contour	FID_PEI_Buildings_90sqm_Vector	GROUND	ROOFTOP	UNIQUE_ID	PERIMETER	Area
1	Multipoint	46204	46204	4.7	40674	4.63	11.54	40673	63.80773	190.055
2	Multipoint	46262	46262	4.8	40674	4.63	11.54	40673	63.80773	190.055
3	Multipoint	46265	46265	4.9	40674	4.63	11.54	40673	63.80773	190.055
4	Multipoint	46286	46286	4.9	40674	4.63	11.54	40673	63.80773	190.055
5	Multipoint	48303	48303	4.4	40674	4.63	11.54	40673	63.80773	190.055
6	Multipoint	48362	48362	4.5	40674	4.63	11.54	40673	63.80773	190.055
7	Multipoint	48426	48426	4.6	40674	4.63	11.54	40673	63.80773	190.055
8	Multipoint	48536	48536	4.7	40674	4.63	11.54	40673	63.80773	190.055
9	Multipoint	48739	48739	4.8	40674	4.63	11.54	40673	63.80773	190.055
10	Multipoint	48194	48194	4.2	40684	5.93	11.42	40683	113.7977	473.685

Sort elevations by Ascending to determine the minimum elevation threshold that impacts infrastructure (buildings/roads).

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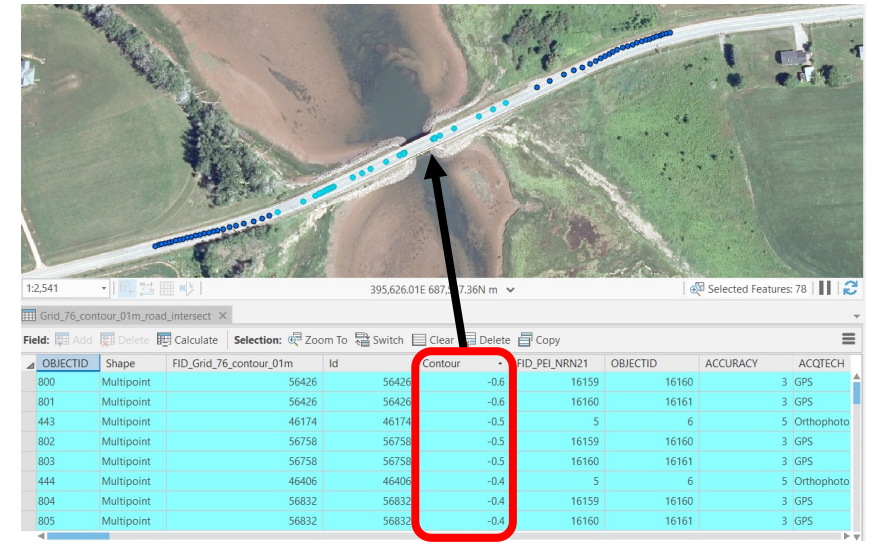
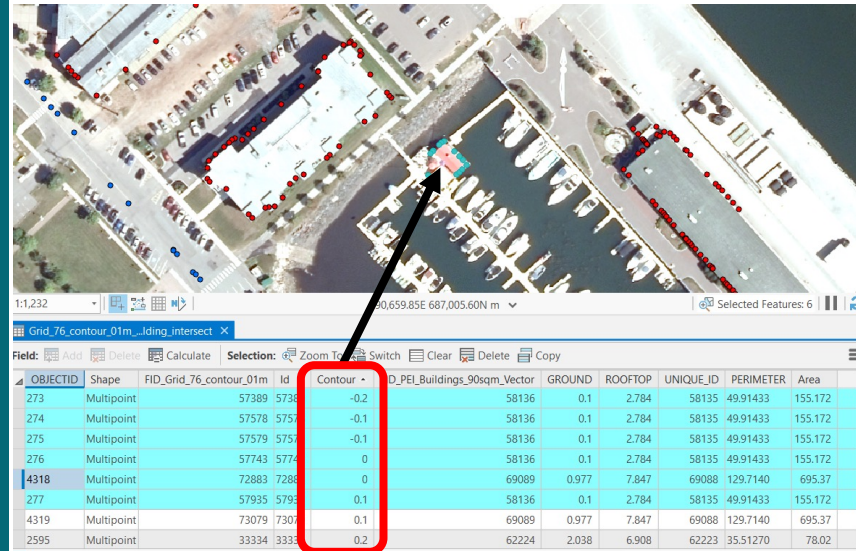


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# Example: Current PACF Engagement with PEI

Remove erroneous intersection points as necessary. i.e. floating buildings or bridge spans (bridges are often removed from LiDAR point cloud)



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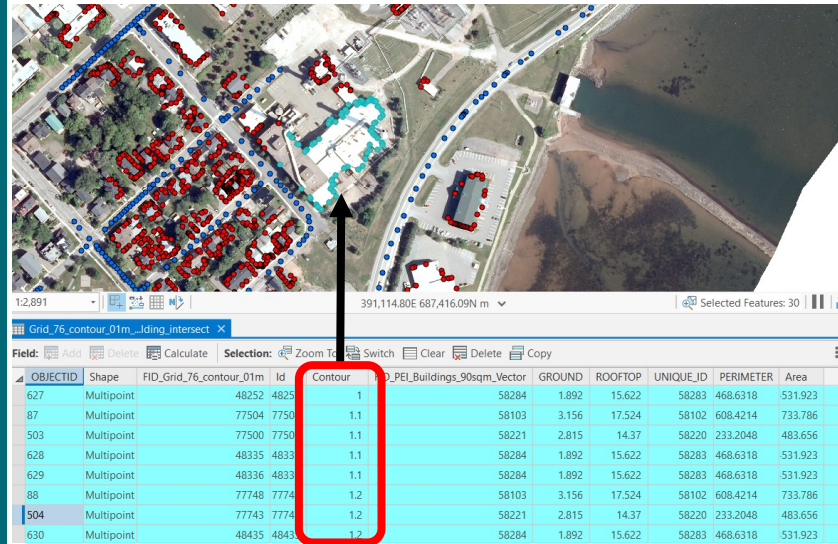


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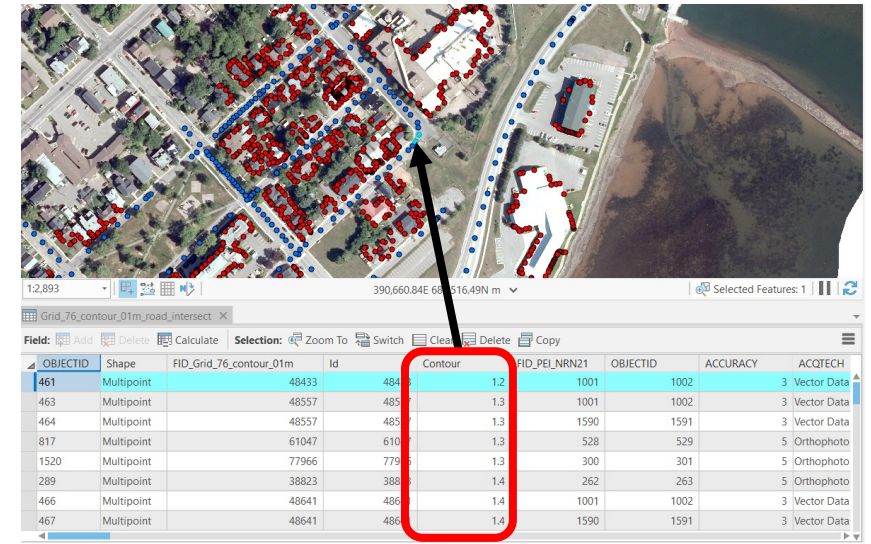
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# Example: Current PACF Engagement with PEI

Minimum building threshold: 1.0 m



Minimum road threshold: 1.2 m



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# Example: Current PACF Engagement with PEI

Proposed Wave Level	Level/ tier/ Category	Possible Disruption Time	Impact		Suggested Response (Call to Action)
			Receptor	Possible Consequence	
<HAT	negligable	NA	NA	none expected	NA
>HAT beach roads, boat launch ramps, wharves	Minimal	Minutes to hours	Damage to infrastructure or property Disruption to travel Danger to life	inconvenience or nuisance flooding inconvenience or nuisance flooding individuals close to the coast maybe caught off guard by the rapid approach of unexpectedly larger waves or stronger currents	personal property in low lying areas needs to be moved or it may get wet be aware of possibly wet nearshore roads be aware of higher than usual water levels, waves or stronger currents
lowest infrastructure or seasonal road, cottage access road/driveway, wharf roads and buildings	Minor	Hours to days	Damage to infrastructure or property Disruption to travel Danger to life	water over banks and in yards or in campgrounds Individual properties in coastal locations affected by spray and/or wave overtopping or slightly flooded basements or sewage backup little or no disruption to travel although wet road surfaces could lead to difficult driving conditions water on bike paths	personal property in low lying areas needs to be moved or may get damaged or destroyed be prepared for the possibility of minor flooding of basements, elevate or relocate property to main floor be prepared for possible longer journey times
lowest infrastructure + 20-30 cm or houses; commercial or other public facilities (restaurant, museum, information centre)	Significant / Major	Days to months	Damage to infrastructure or property Disruption to travel Danger to life	Main floor flooding affecting properties and parts of communities Damage to buildings/structures is possible. Disruption to travel is expected. water over the road is deep enough to make driving unsafe	Disruption to key sites identified in flood plans (e.g. railways, utilities) A number of roads should be closed.
lowest critical infrastructure or main roads (or access roads to multiple houses)	Severe / Extreme / Critical	Months to years	Damage to infrastructure or property Disruption to travel Danger to life	Widespread flooding affecting significant number of properties and whole communities Collapse of building/structures is possible multiple homes are flooded or moved off foundations Many cars will likely be submerged or washed away. Several sections of nearshore roads and escape routes will be impassable and a few could be washed out. Danger to life due to fast flowing/ deep water / wave overtopping/ wave inundation	Widespread disruption or loss of infrastructure identified in flood plans (e.g. railways, utilities, hospitals) Several sections of roads and escape routes should be closed. Large scale evacuation may be required

- Minimal threshold:** beach roads, boat launch ramps, wharves
- Minor threshold:** seasonal road, cottage access road/driveway, wharf roads and buildings
- Major threshold:** houses; commercial or other public facilities (restaurant, museum, information centre)
- Severe threshold:** main roads (or access roads to multiple houses)

	A	J	M	N	O	P	Q	R	S	T
1	Grid Cell	Area Name	Minimal	Minimal_Notes	Minor	Minor_Notes	Major	Major_Notes	Severe	Severe_Notes
77	76	Charlottetown East	1.4	parking lot	1.8	access roads to harbour/cr	1.5	restaurant (lobster on t	2.7	road/bridge (Fort Augustus?)
78	77	Stratford	0.9	shooting range building	2.4	access road (Keppoch bea	2.4	house	4.4	road/bridge (Keppoch rd)
79	78	NA								
80	79	Grand Tracadie	1	harbour buildings	0.9	road	1.6	house		
81	80	Johnstons River	1.5	beach road			1.2	house	2.7	road/bridge
82	81	Alexandra	0.8	back road			1.2	house	1.4	road/bridge
83	82	Point Prim					1.7	cottage/house	1.4	access road
84	83	Point Deroche	1.4	beach access road/parking			0.8	house	1.5	access road to cottage subdivision
85	84	Earnscliffe	2	wharf infrastructure	1.6	road to farm	2.5	cottage		
86	85	Pinette	1.4	wharf infrastructure	1.6	access road to wharf	1.6	house	3.3	road/bridge
87	86	Flat River	1.2	beach road			1.5	house	1.5	access road to houses
88	87	Savage Harbour	1.5	wharf infrastructure	0.9	access road to house	1.7	house	1.4	road/bridge
89	88	Orwell			1.2	access road to cottages	1.2	house	2	road access to houses
90	89	Belle River	1	beach road	1.2	access to fish plant	1.6	Commercial building (f	3.5	road/bridge

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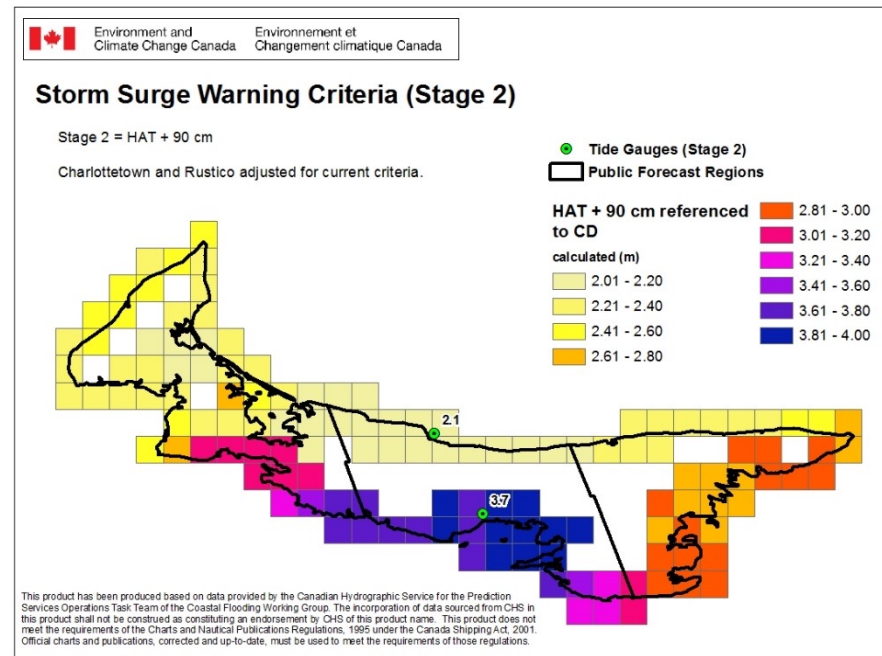


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## Example: Current PACF Engagement with PEI

- This information will be used to add precision to our coastal flooding products.
- Alerts will be sent when ECCC thinks that the water level will exceed the thresholds provided by the Province.



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## What the PACF is not...

- At this time, capabilities are being developed under PACF to forecast:
  - Tides
  - Storm Surge
  - Increase of water at the shoreline level due to incident waves

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## What the PACF is not...

- ECCC is **NOT** developing the capacity to forecast flooding due to:
  1. Tsunami: waves caused by the displacement of a large volume of water (earth quake, landslide, etc.).
  2. Flash floods: an excessive amount of rain in a short period of time.
  3. River floods: when water levels run over river banks, as a result of heavy rain or snow melt.
- We do recognize the water dynamics that occur at the mouth of rivers and will work with River Forecasting Centers to support their alerting programs.



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## What the PACF is not...

- We've Narrowed the scope of coastal flooding 'Impact' to the short term:
  - Damage to infrastructure or property
  - Disruption to travel
  - Danger to life
- PACF is **NOT** at this time trying to forecast the impacts from:
  - Erosion
  - Deterioration of health conditions from waterborne diseases.
  - Socio, economic and psychologic impacts on individuals or communities from:
    - disruption to industry
    - loss of infrastructure
    - displacement of people
    - loss of livelihoods
    - reduction in purchasing power and loss of land value in the floodplains that can leave communities economically vulnerable.

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## What the PACF is not...

- ECCC is **NOT** developing flood maps or studies for municipal or indigenous community EMO's
- However, through the PACF, we would like to work with you and any information you may already have to inform the coastal flooding alert products for your community.
- Do you have a planning or public works (roads, water/wastewater infrastructure) or engineering department?
- Do you know someone that knows the elevation of the lowest road or building along your coast?

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## What the PACF is not...

- Climate Change or long term community planning and mitigation.
  - We recognize the changing risk of coastal flooding due to climate change but our products and services are intended to be used in the shorter term.

“Should you be concerned about coastal flooding from the storm that’s forecast to arrive later this week?”

# Thank You!

If you haven't yet, please quickly fill out our Menti if you wish to know more, or may be able to direct us to representatives in your municipalities that can advance this work!

Please [www.menti.com/5icnz5j52r](https://www.menti.com/5icnz5j52r)  
or the **QR code** on the bottom left

For an example of our mapping, use the QR code on bottom right.



Menti Survey

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ECCC's Interactive  
Coastal Flooding Map

# Annex

The following slides contain additional background information on coastal flooding and its causes

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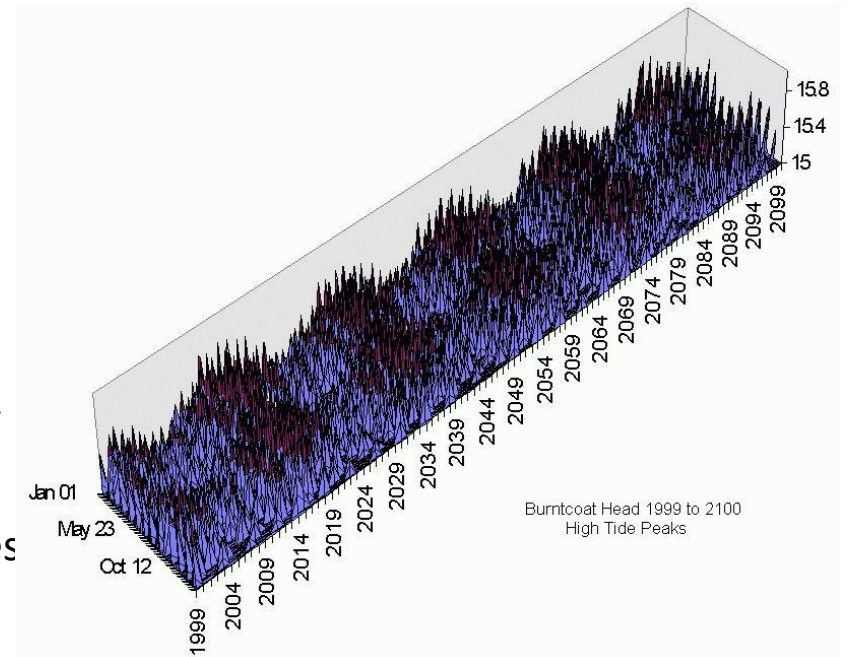
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# What is Coastal Flooding?



## Astronomic Tides

- When does knowing tides become more important?
- Long term: Lunar precession
  - 18.61 years
  - Min Lunar/Solar Declination
  - Everything else being equal
    - will increase max tides by about 3.7%.
    - 9.3 years later, it will drop the max tides by 3.7%
  - So this matters most for large tidal ranges



Maxima	1978	1997	2015	2034	2053
Minima	1969	1987	2006	2025	2043

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    - ✓ • Tides
    - Atmospheric wind and pressure
    - Seiche (harbours)
    - Waves (set-up / run-up)
  - Longer time scales
    - De-glaciation (more water in the oceans)
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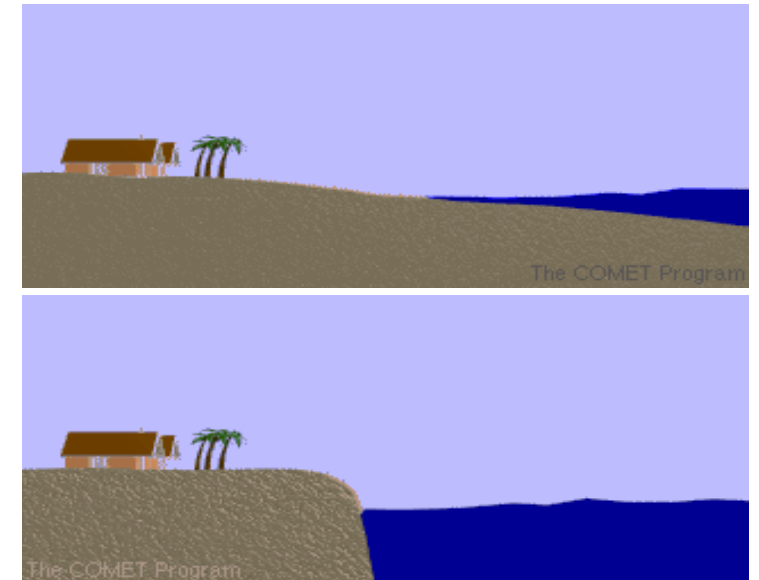
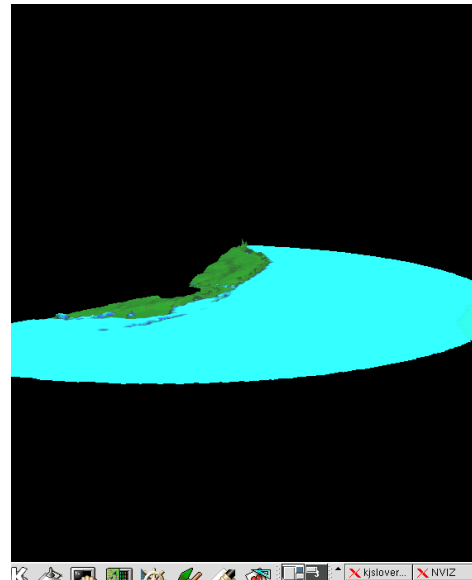
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## Atmospheric wind and pressure

What's another name for the ocean and lakes response to changes in wind and atmospheric pressure?

**Storm Surge!**



The shape and depth of the coastline plays an important role



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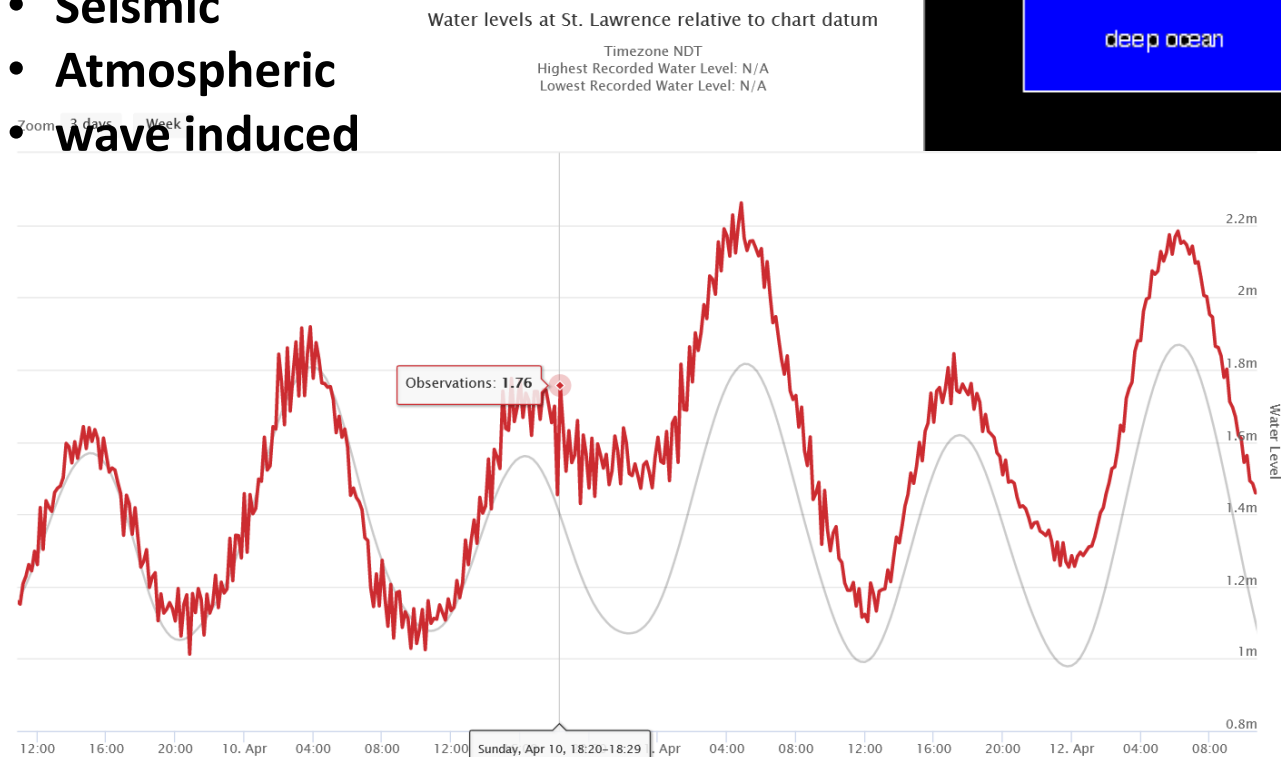
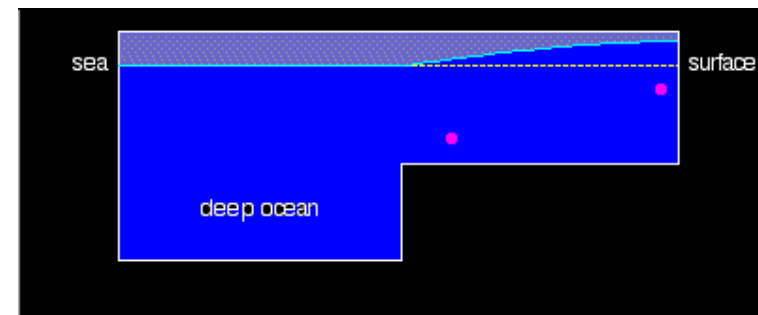


## Seiche (harbours)

The oscillation of water level in a harbor.

Could be started by:

- Seismic
- Atmospheric
- wave induced



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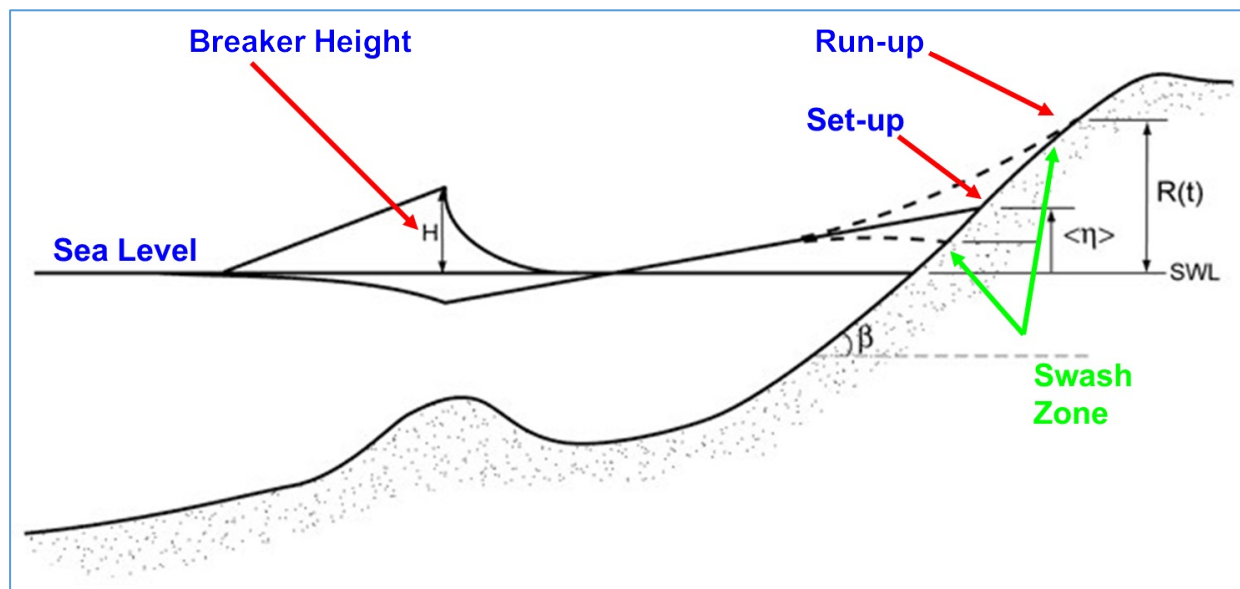
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### Waves (set-up / run-up)

- **Wave set-up**
  - Is rise in water due to flow of water towards the shoreline due to breaking waves.
- **Wave run-up**
  - Is the recurrent encroachment of waves onto and running up the beach in rhythm with the waves.



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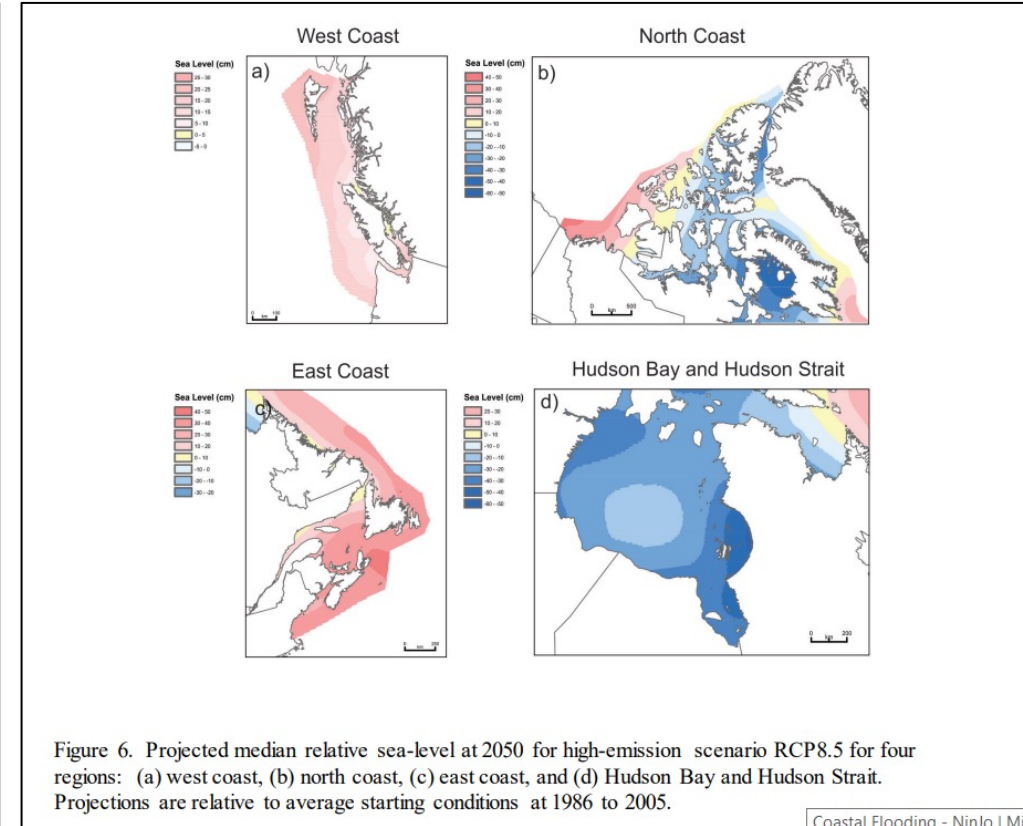
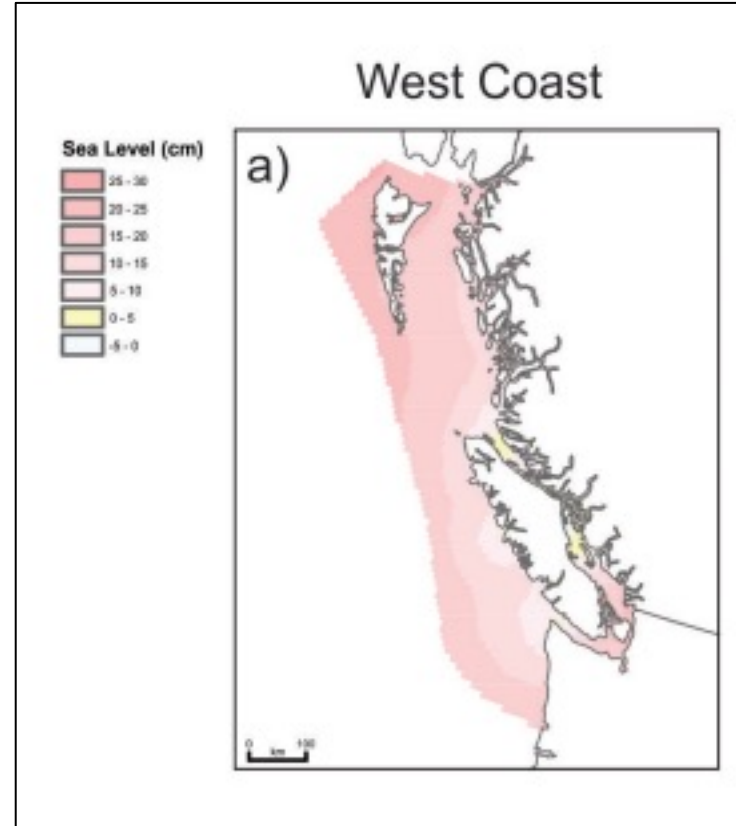
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## Relative Sea Level Rise (RSLR)



Coastal Flooding - Niinjo | MIT

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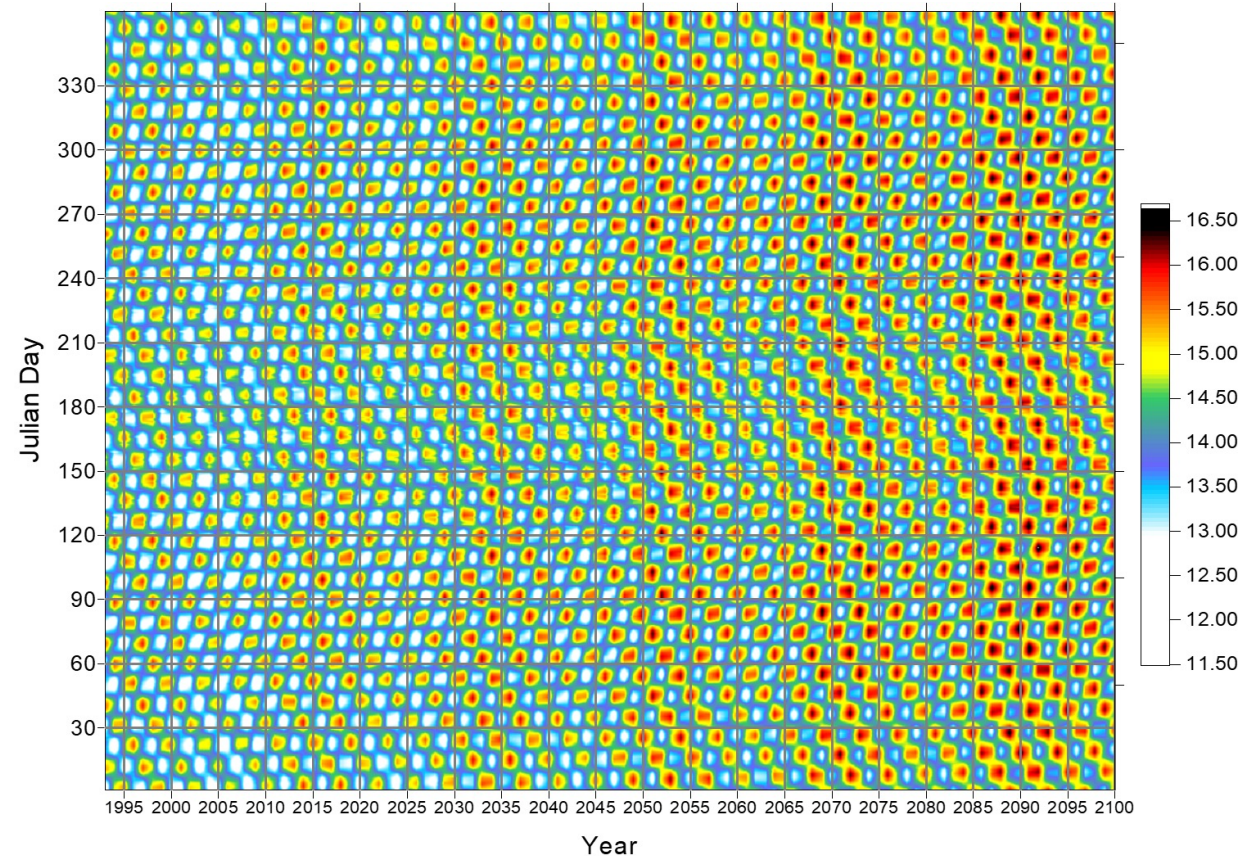
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## Relative Sea Level Rise (RSLR)

### Lunar precession

- 18.61 years
- So this matters most for large tidal ranges
- Like in BC



Burntcoat Head - 1993 to 2100 - Highest Daily Tide  
(Adjusted for Sea Level Change due to Crustal Subsidence and the Impacts of Climate Change)

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## What are some Impacts due to coastal flooding?

- Feb 4 2006 event at Beach Grove, Tsawwassen
  - More than 150 homes were damaged when a combination of high winds and an extremely high five meter tide washed out a section of the seawall along Boundary Bay.



WAVES CRASHING ON BOUNDARY BAY



FLOODING ON BEACH GROVE ROAD



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- Dec. 20, 2018 White Rock Pier
  - A violent storm, spectators looked on in disbelief as high waves and fierce winds drove moored boats and a loose section of marina wharf into the city's iconic pier, a fixture on the waterfront since 1914.
  - The onslaught rammed a hole in the structure which soon widened into a horrifying 100-foot gap.



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# What are some Impacts due to coastal flooding?

- Jan 12 2020 Beachcomber Marina in Nanoose Bay



A boat came unmoored on Sunday, Jan. 12 at the Beachcomber Marina in Nanoose Bay and crashed on the rocks of a nearby shore. Coast Guard members say the boat's owner has been notified. (Emily Vance photo)



Approximately 150 feet of the breakwater at the Beachcomber Marina in Nanoose Bay has crumbled after gale-force northwesterly winds combined with a high tide battered the rocks on Sunday, Jan. 12. (Emily Vance photo)



The French Creek Base of the Coast Guard was called in to the Beachcomber Marina in Nanoose Bay on Sunday, Jan. 12 for a severe windstorm. Crews returned on Monday to help clean up the damage done to the marina and boats. (Emily Vance photo)

## ‘It was mayhem’: Storm causes huge damage at Vancouver Island marina

Boat crashes ashore, 150 feet of breakwater crumbles at the Beachcomber Marina in Nanoose Bay

EMILY VANCE / Jan. 13, 2020 3:00 p.m. / LOCAL NEWS / NEWS

A neighbor who lives just above where the boat crashed onto the rocks. The crash happened around 7 p.m. on Sunday night.

The marina itself also sustained serious damage from the elements. Approximately 150 feet of the breakwater has been knocked down by massive waves caused by the winds.

Residents say once the breakwater started to fall, the waves began to batter the marinas outer docks.

Some of the docks themselves have come apart, while other sit half-sunken in the water.

Beachcomber resident, says she's never seen anything like it in her 14 years living in the area.

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- Jan 7 2022 English Bay, Stanley Park, Kitsilano, Qualicum Beach
  - The pier at Jericho Beach has suffered extensive and water flooded into the nearby compound of the Jericho Sailing Centre.
  - The Sand Pebbles Inn in Qualicum Beach suffered significant damage after giant waves battered the town's waterfront
  - The District of West Vancouver also closed its seawall and Ambleside Park, which was partially flooded.
  - Stanley Park's seawall was damaged

