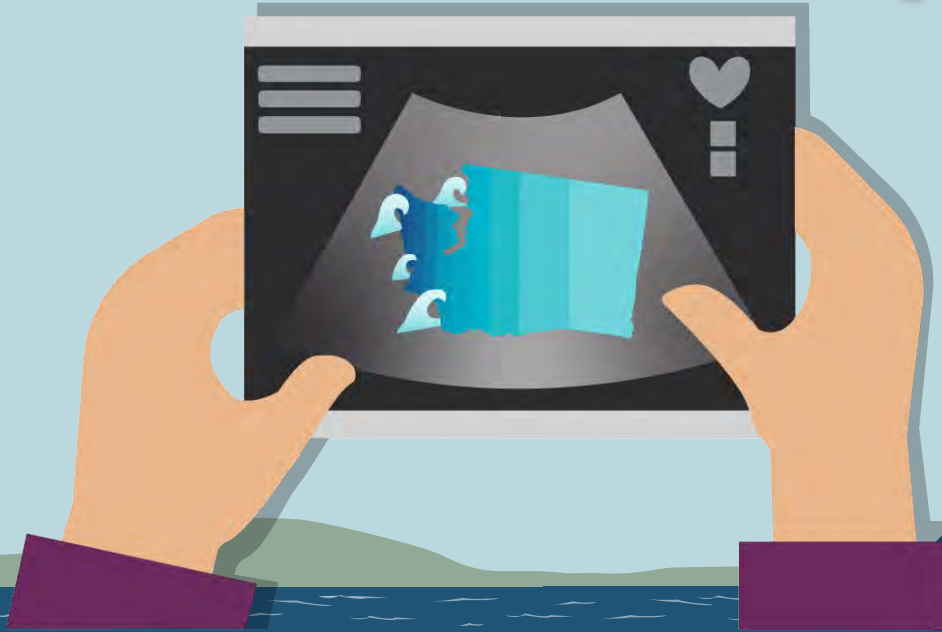


WHAT TO EXPECT WHEN YOU'RE EXPECTING

# a *TSUNAMI*



# Tsunami Hazards in Washington State



Maximilian Dixon – Washington Emergency Management Division

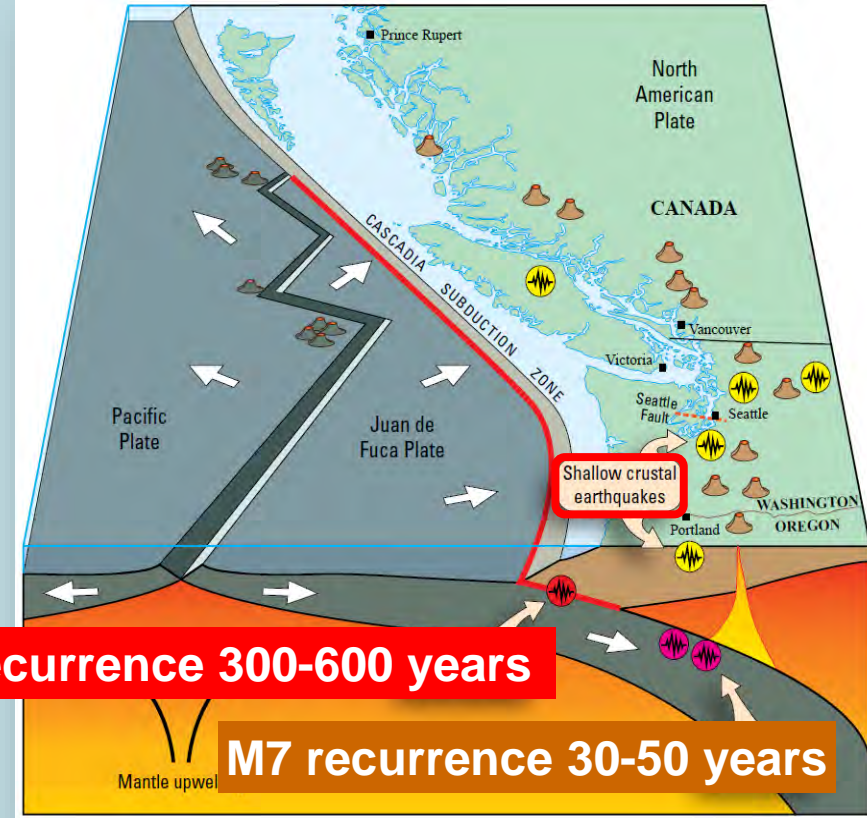


# Geological Hazards in Washington

**WA has the 2<sup>nd</sup> highest earthquake risk in the US**

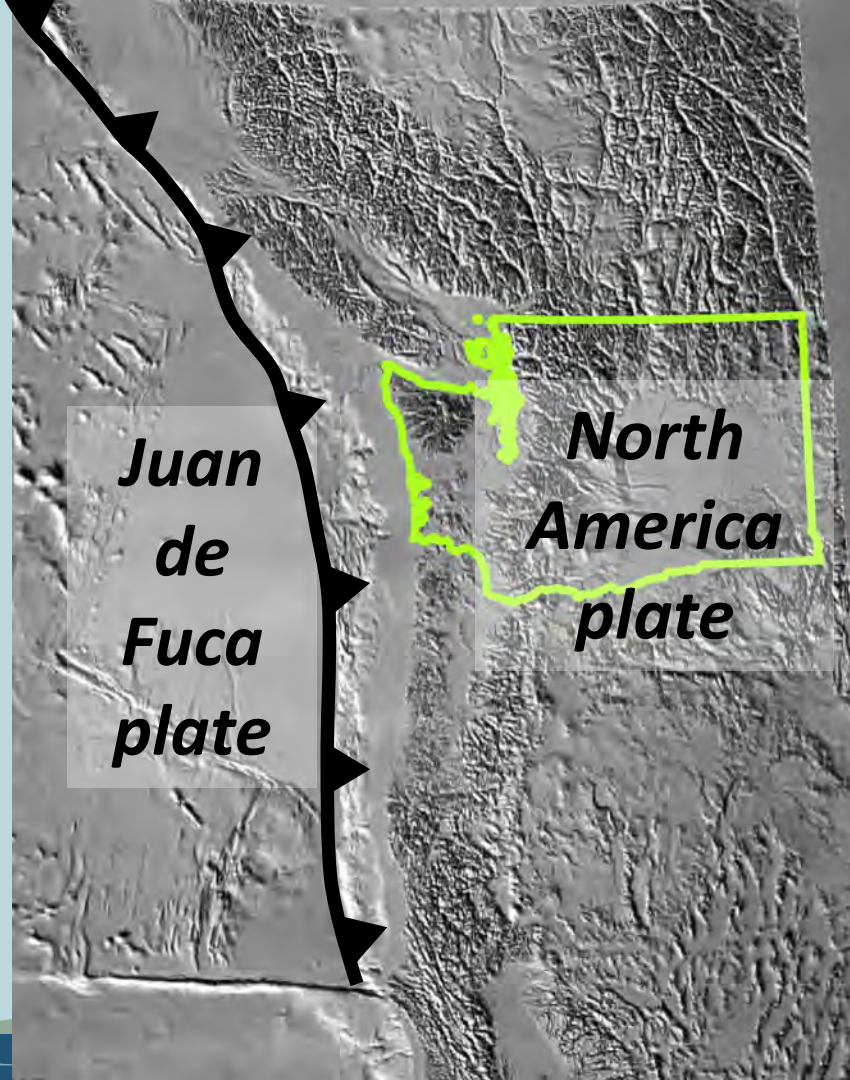
We also have...

- **Tsunamis** - local and distant
- 5 active volcanoes
- Landslides



# Cascadia Subduction Zone

- 700 miles long (1,130 km)
- Breaks 300 – 600 years (~500 years on average)
- Last great rupture in 1700 (320 years ago)
- 10-20% chance within next 50 years
- Magnitude 8.0-9.0+
- Shaking felt region-wide for 3–6 minutes
- Shaking intensity is greatest along coast & where local conditions amplify seismic waves
- Earthquake followed by a **major tsunami hitting WA's outer coast in 15-20 min**
- Many large aftershocks will follow main quake



# Distant vs Local Tsunamis

## Distant

- No earthquake felt
- > 3 hours until first wave arrives
- Warning must be distributed
- Less inundation/slower currents
- Less severe impact to coast



## Local

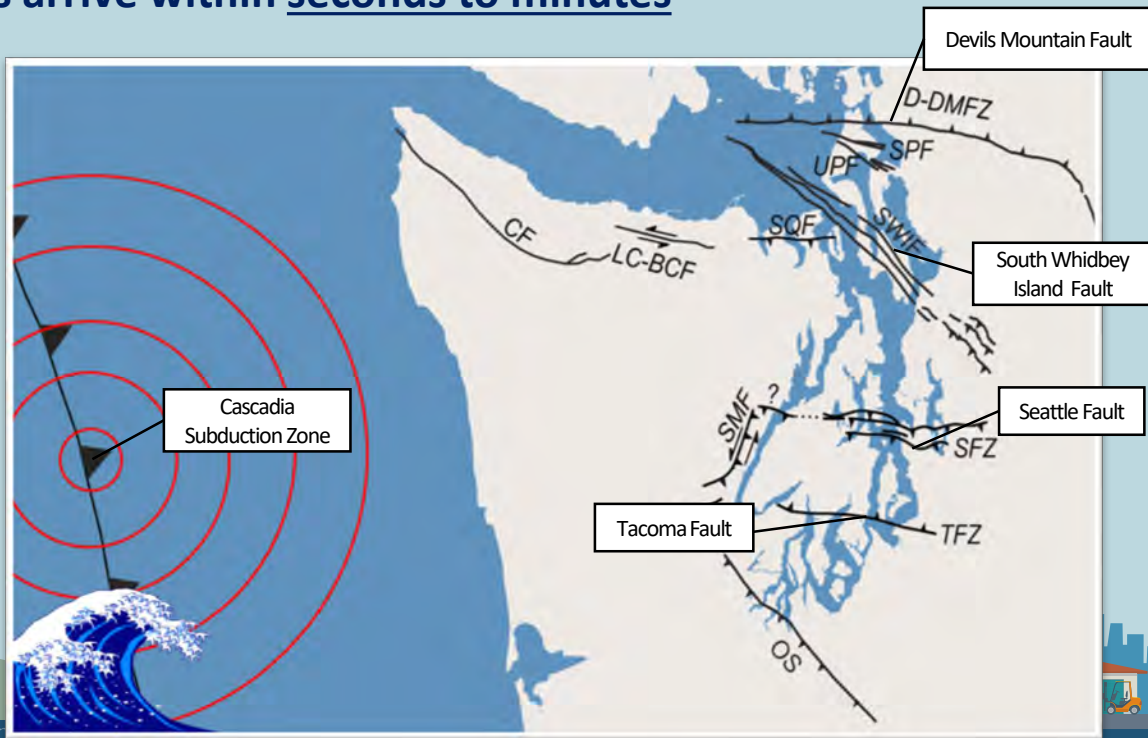
- Event will typically be felt
- < 3 hours until first wave arrives
- Earthquake is primary warning
- More inundation/faster currents
- Significant impact to coast



# Local Tsunamis

**THE SHAKING IS YOUR WARNING!**

The first waves arrive within seconds to minutes



# Know the Natural Tsunami Warning Signs

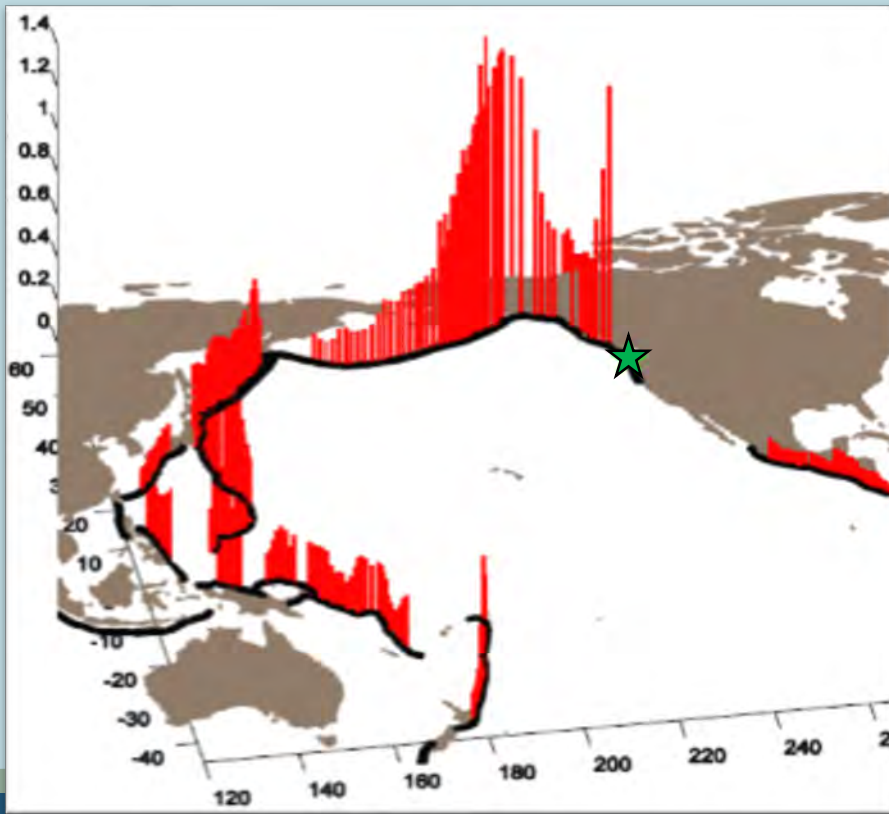
1. Feel a long or strong ground shaking at the coast
2. See a sudden rise or fall of the ocean
3. Hear a loud roaring sound coming from the ocean

If you experience any of these, it's time to **grab your go-bag and head to high ground!**



# Distant Tsunami Threats - Alaska

The first waves arrive in less than 4 hours



You will **NOT** feel ground shaking for a distant tsunami!

Instead, you might be warned through official alerts like...

- EAS
- WEA
- Tsunami sirens





# Tsunami Alerts

Alert Name	Actions	Potential Hazards
 <b>WARNING</b>	Get to high ground or inland <b>IMMEDIATELY</b> Follow tsunami evacuation signage	<b>DANGER! TSUNAMI IMMINENT!</b> Flooding/powerful currents Wave heights > 3 ft. or unknown
 <b>ADVISORY</b>	Stay out of the water and away from the shore	<b>STRONG CURRENTS AND DANGEROUS WAVES</b> in or very near coastal water Wave heights of 1 - 3 ft.
 <b>WATCH</b>	Be prepared to take action Stay tuned to local radio/TV/ NOAA "alert" weather radios	<b>TSUNAMI IS POSSIBLE</b> Alert level <i>will</i> change once more information is known
 <b>INFORMATION STATEMENT</b>	No action needed	<b>NO TSUNAMI IMPACT EXPECTED</b> Alert level may change once more information is known

**THREAT Message: Intended to alert international partners only. Not applicable to U.S. coasts**

**THE NATIONAL TSUNAMI WARNING CENTER ISSUES OFFICIAL TSUNAMI ALERTS FOR WASHINGTON.  
CHECK TSUNAMI.GOV OR WEATHER.GOV WEBSITES FOR TSUNAMI ALERT DETAILS.**



# Tsunami Alert Dissemination

- Tsunami alerts occur for any type of tsunami event
- They are MOST important during a DISTANT source event

How do you receive alerts?

How to do you stay informed?



# NWS: Tsunami Warning Centers

Pacific  
Tsunami  
Warning  
Center  
(Honolulu, HI)



International  
warning  
center for 26  
member  
countries and  
Hawaii

National  
Tsunami  
Warning  
Center  
(Palmer, AK)

Issues all  
tsunami  
products for  
AK, BC, WA,  
OR, CA – all of  
North America



# Example Messages

## NTWC Message #4 (3:41 PM PST)

BULLETIN  
Public Tsunami Message Number 4  
NWS National Tsunami Warning Center Palmer AK  
239 PM AKDT Mon Oct 19 2020

### UPDATES

-----

- \* Updated observations



...THE TSUNAMI WARNING REMAINS IN EFFECT...

Tsunami Warning in Effect for;

- \* SOUTH ALASKA AND THE ALASKA PENINSULA, Pacific coasts from Kennedy Entrance, Alaska (40 miles SW of Homer) to Unimak Pass, Alaska (80 miles NE of Unalaska)

For other US and Canadian Pacific coasts in North America, there is no tsunami threat.

## PTWC Message #2 (3:11 PM PST)

- \* AN EARTHQUAKE WITH A PRELIMINARY MAGNITUDE OF 7.5 OCCURRED SOUTH OF ALASKA AT 2055 UTC ON MONDAY OCTOBER 19 2020. NOTE THAT THE MAGNITUDE HAS BEEN UPDATED.
- \* BASED ON ALL AVAILABLE DATA... THE TSUNAMI THREAT FROM THIS EARTHQUAKE HAS NOW PASSED.

TSUNAMI THREAT FORECAST...UPDATED

-----

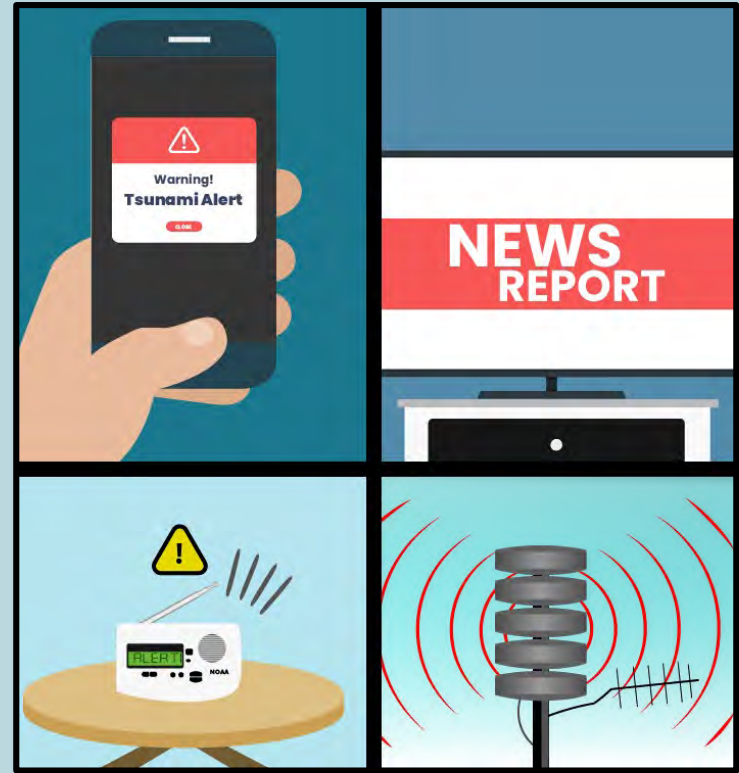
- \* THERE IS NO LONGER A TSUNAMI THREAT FROM THIS EARTHQUAKE, EXCEPT FOR THE IMMEDIATE EPICENTRAL AREA.

- \* COASTAL REGIONS OF CALIFORNIA... OREGON... WASHINGTON... BRITISH COLUMBIA AND ALASKA SHOULD ONLY REFER TO U.S. NATIONAL TSUNAMI WARNING CENTER MESSAGES THAT CAN BE FOUND AT [WWW.TSUNAMI.GOV](http://WWW.TSUNAMI.GOV).



# Alert Dissemination

- Emergency Alert System (EAS) - Originally designed for the President to address the nation in times of disaster
  - Life-threatening weather and natural hazards
  - Law enforcement alerts (Amber Alerts, etc)
- NOAA weather radio - broadcasts warning information for all types of hazards
- Wireless Emergency Alerts (WEA) - Used **ONLY** when a tsunami warning is issued
  - You will only receive ONE message, once!
  - Even if you have a WEA-enabled device, you may not receive a WEA:
    - If your device is roaming
    - In a service area where the provider is not offering WEA



# All Hazard Alert Broadcast (AHAB) Tsunami Sirens

- OUTDOOR tsunami warning system intended to warn people on/near the beach
  - Sirens have an approximately 1-mile audible range depending on topography, weather, and barriers
- Currently 95 sirens
- The state Alert and Warning Center activates sirens upon receipt of an official Tsunami warning from the NTWC
- Monthly test: Westminster Chimes
- Tsunami warning: wailing tone followed by verbal instructions in English and Spanish



# Tsunami.gov

- Visually displays where earthquakes occur and alert levels
- Look for messages for: AK/BC/US West Coast
- Lists last 40 messages issued at the bottom
- Links to all sorts of additional information
- There will NOT be information for the inner coast for a CSZ earthquake
- Has a history of crashing during big events

United States Department of Commerce  
NOAA / National Weather Service  
U.S. Tsunami Warning System

Home News Organization Search for:   NWS  All NOAA

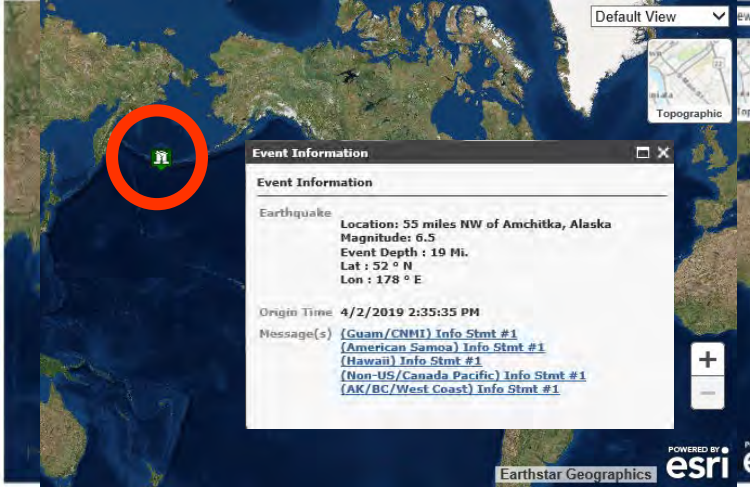
## No Tsunami Warning, Advisory, Watch, or Threat

**Earthquake:**  
Magnitude: 4.1      Origin Time: 3/29/2018 4:55:38 PM  
Depth: 11 mi      Lat: 18° N Lon: 68.1° W  
Location: ABOUT 12 MILES SOUTHWEST OF ISLA MONA

Note: Times are local to your browser, unless otherwise indicated      See the map or table below for more info

Alerts/Threats    Earthquakes  
 Previous 40 Messages    Observations    Forecasts    Water-Level Stations    DART Systems    Travel Time    Auto Update

Default View



**Event Information**


**Earthquake**  
Location: 55 miles NW of Amchitka, Alaska  
Magnitude: 6.5  
Event Depth: 19 Mi.  
Lat: 52° N  
Lon: 178° E

Origin Time: 4/2/2019 2:35:35 PM

Message(s): [\(Guam/CNMI\) Info Stmt #1](#)  
[\(American Samoa\) Info Stmt #1](#)  
[\(Hawaii\) Info Stmt #1](#)  
[\(Non-US/Canada Pacific\) Info Stmt #1](#)  
[\(AK/BC/West Coast\) Info Stmt #1](#)

Warning   Advisory   Watch   Threat   Earthquake

U.S. / Canada   International   More earthquake info

POWERED BY 

**Previous 40 Tsunami Messages**

Issued	Origin Time	Meg	Depth	Lat	Lon	Location	Messages	Additional Resources
03-29-2018 23:50:28	03-29-2018 23:55:30	4.1	11 Mi.	18° N	68.1° W	ABOUT 12 MILES SOUTHWEST OF ISLA MONA	PR/Virgin Isl. Informational #1	Select Resources
03-29-2018 22:46:52	03-29-2018 21:25:35	7.2	6 Mi.	5.6° S	151.6° E	NEW BRITAIN REGION PAPUA NEW GUINEA	Non-US/Canada Pacific Threat #3	Select Resources
03-29-2018 21:57:46	03-29-2018 21:25:35	7.2	6 Mi.	5.6° S	151.6° E	NEW BRITAIN REGION PAPUA NEW GUINEA	Non-US/Canada Pacific Threat #2	Select Resources

# Alerting for the Inner Coast

- Currently the NWS does not have forecasting or alerting capabilities for the inner coast (Puget Sound and Salish Sea) for a Cascadia Subduction Zone earthquake and Distant tsunamis
- This means: NO NOAA Weather Radio, EAS, Tsunami.gov, or forecasted wave arrival times on tsunami bulletins for inner coast locations
- WA EMD will send a WEA message for tsunami warnings to the inner coast





# Tsunami Impacts In Washington

Alex Dolcimascolo

Tsunami Geoscientist

Washington Geological Survey

Department of Natural Resources



WASHINGTON STATE DEPT OF  
**NATURAL  
RESOURCES**  
WASHINGTON  
GEOLOGICAL SURVEY

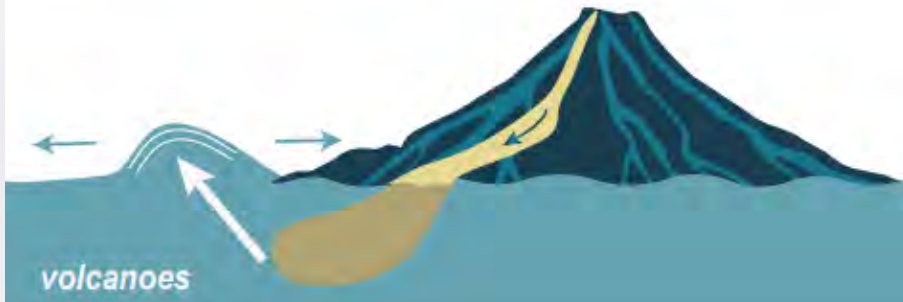
# Learning From History

- 2011 Japan Earthquake (Magnitude 9.1) and tsunami (125 feet high in places)
- An estimated **20,000 people were dead or missing** and close to 500,000 people were forced to evacuate.
- The total economic cost could reach up to \$235 billion, the World Bank estimated, making it the costliest natural disaster in world history.
- The 2004 magnitude 9.1 Banda Aceh earthquake and tsunami in Sumatra **killed more than 230,000 people**



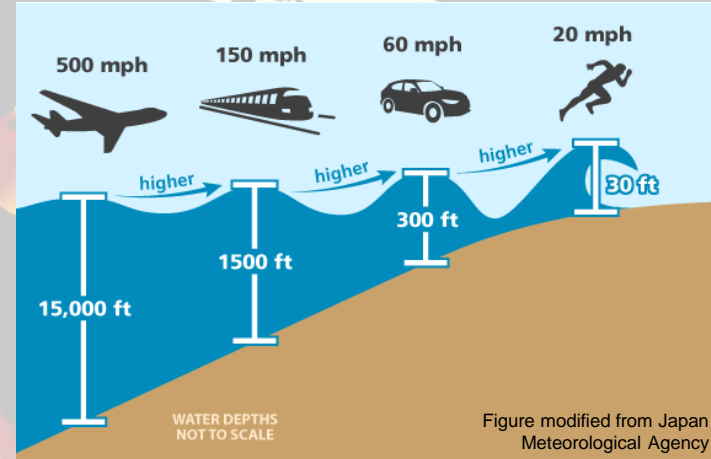
Photo credits unknown

Tsunamis occur when large quantities of water are displaced, most commonly because of earthquakes, landslides, or volcanic eruptions. Tsunamis can also be produced by atmospheric disturbances or meteorite impacts, but these are rare.



# Tsunamis

- Tsunamis involve **multiple waves**—the first tsunami wave may not be the biggest in the series.
- Tsunami waves are **huge** in width, length, and depth
- The tsunami **may not cease for hours to days**.
- Tsunamis create **powerful currents** that cause damage and carry large, hidden objects within them. You cannot swim through a tsunami.
- Tsunamis **cannot be predicted**. We know what types of earthquakes can cause them but not when they will happen.



*Tsunami waves reach farther inland along gently sloping coastlines*

*Tsunami waves are blocked by steep coastlines*

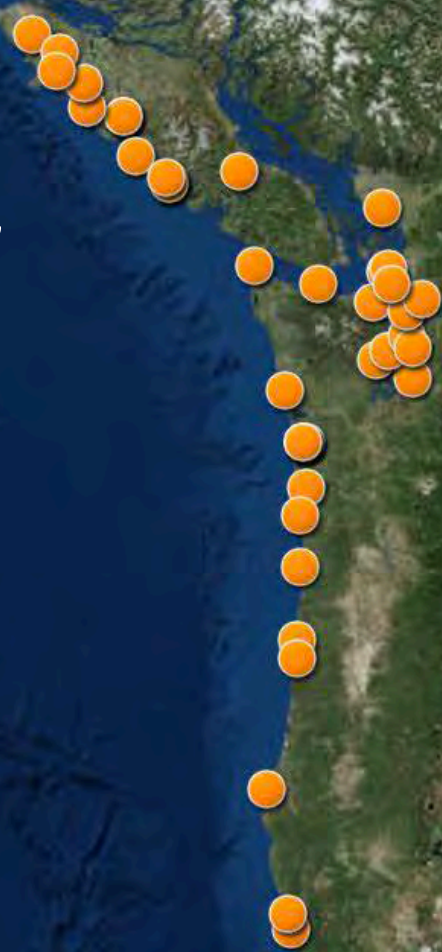
*Tsunami waves are dampened by vegetation*

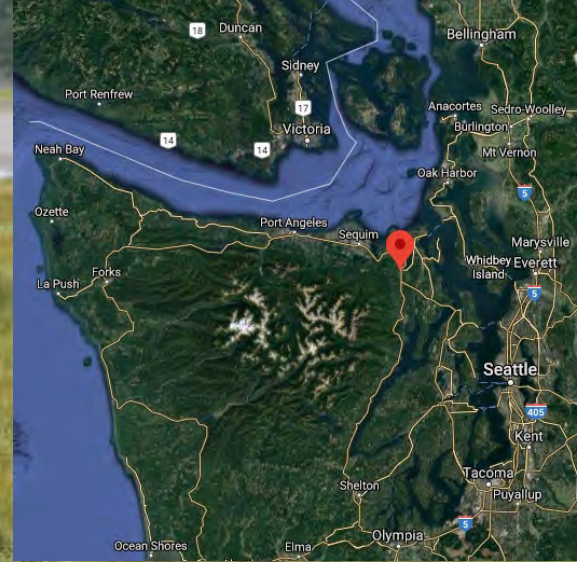
# Local Tsunami Sources: Crustal Faults- Seattle Fault

(Last ruptured in ~ 1,100 years ago)



# *Tsunami deposits*





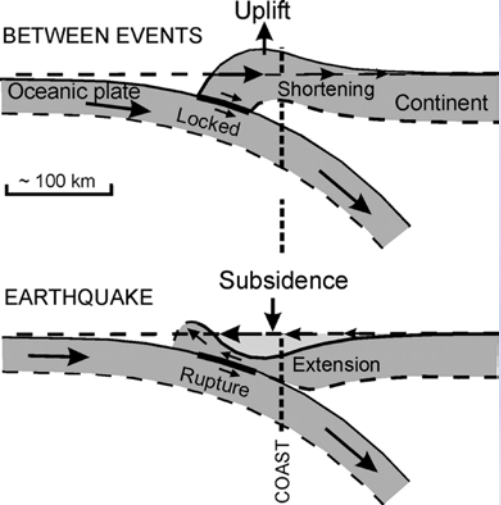
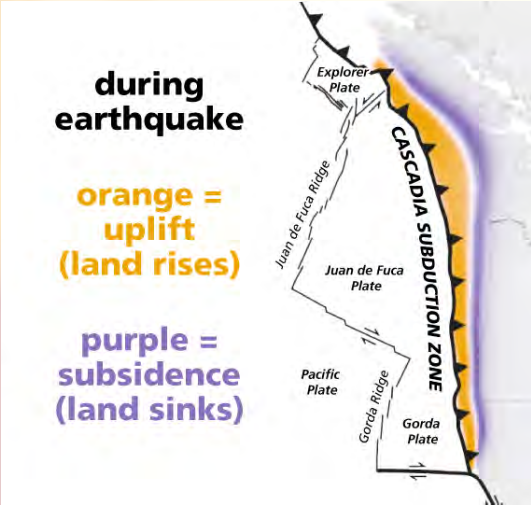
# Tsunami Modeling Can Estimate:

- Wave arrival times
- Tsunami wave amplitude (height of wave offshore)
- Tsunami inundation depth (height of water over previously dry land)
- Tsunami extent (distance tsunami wave will travel inland)
- Duration of tsunami wave action
- Tsunami current velocity



# Modeling earthquakes and tsunami inundation

Use models of fault ruptures to simulate ground displacement and wave propagation across ocean and within Puget Sound



Tsunami inundation models show the amount of water that is expected to travel inland

Figure from Washington Sea Grant

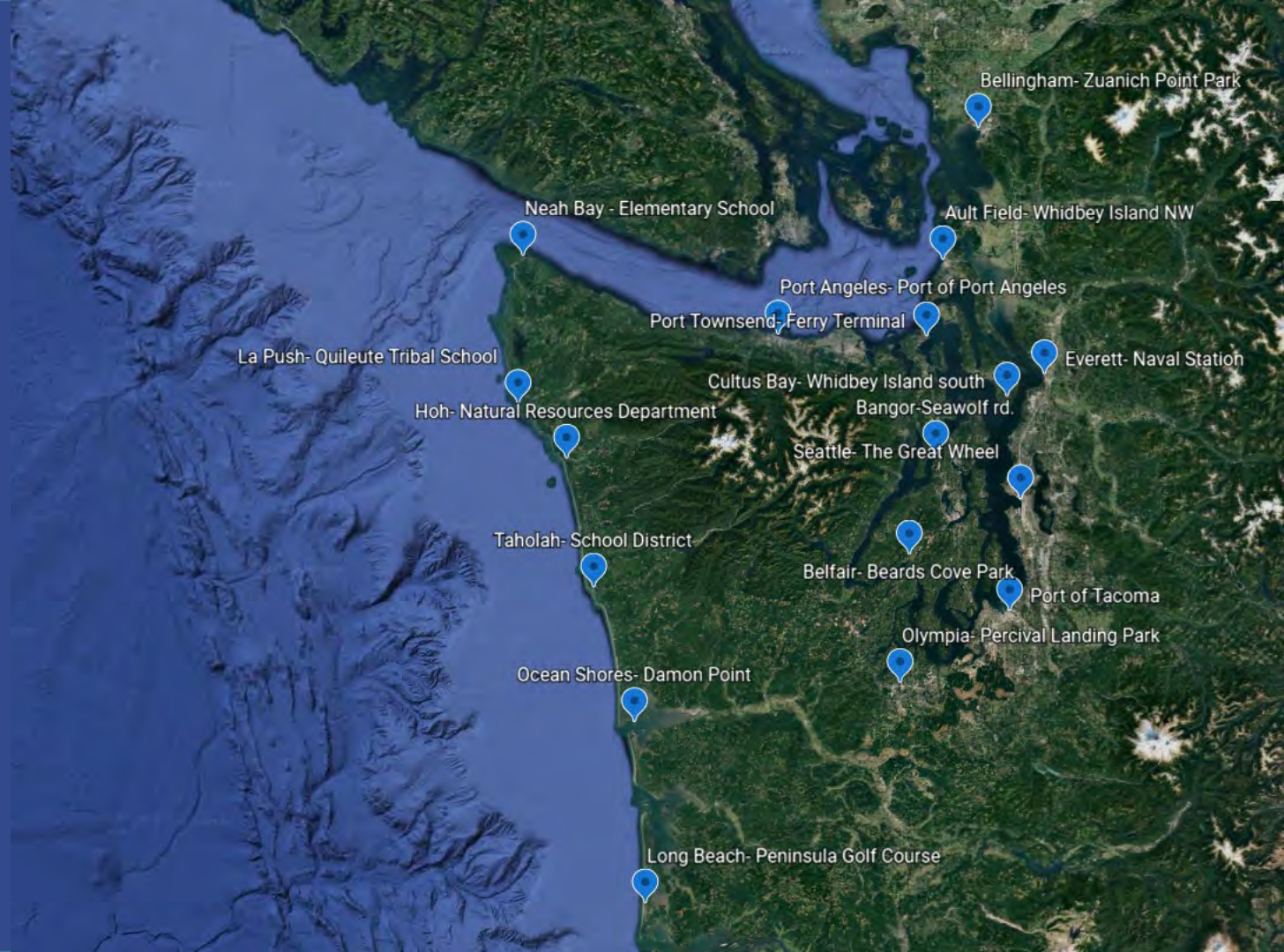
Figure from Leonard et al., 2003

# Tsunami Modeling Assumptions:

- Simplified fault models (uniform slip, full rupture, etc.)
- Results are referenced to mean high water (waves could be higher or lower if it is a king tide or low tide)
- Waves are not interacting with the buildings, vegetation, or built environment (bare earth models)
- Do not account for seismically induced landslides

# Tsunami Inundation and Approximate Wave Arrival Times

Locations where estimated wave arrival and inundation depths will be shown

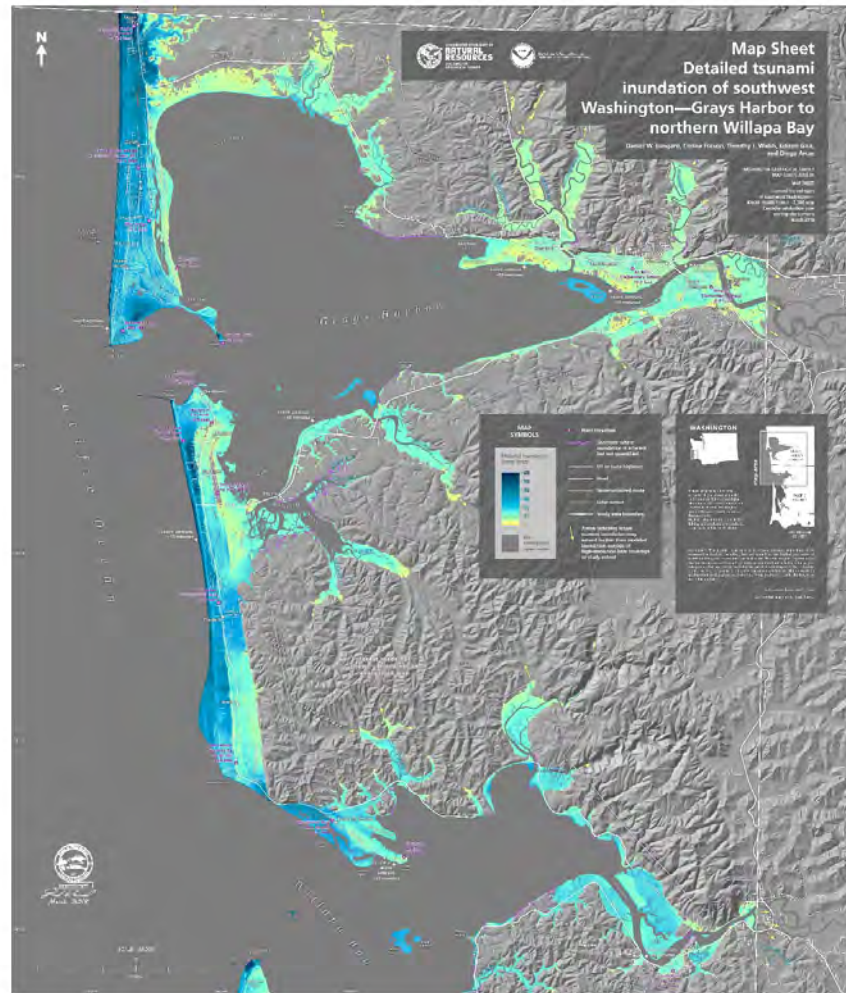
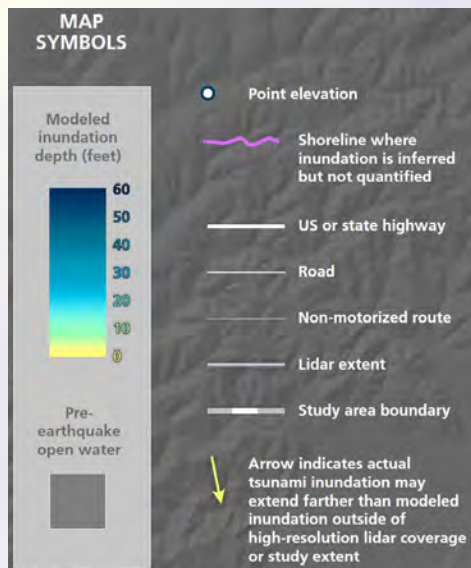


LOCATION	CSZ ESTIMATED WAVE ARRIVAL	CSZ APPROX. INUNDATION	SF ESTIMATED WAVE ARRIVAL	SF APPROX. INUNDATION
LONG BEACH- PENINSULA GOLF COURSE	~15 MINUTES	~17 FT	Not Available	Not Available
LA PUSH- QUILEUTE TRIBAL SCHOOL	~15 MINUTES	~30 FT	Not Available	Not Available
OCEAN SHORES- DAMON POINT	~ 20 MINUTES	~61 FT	Not Available	Not Available
HOH TRIBE NATURAL RESOURCES DEPARTMENT	~ 20 MINUTES	~6 FT	Not Available	Not Available
TAHOLAH SCHOOL DISTRICT	~ 20 MINUTES	~32 FT	Not Available	Not Available
NEAH BAY ELEMENTARY SCHOOL	~ 20 MINUTES	~24 FT	Not Available	Not Available
PORT ANGELES- PORT OF PORT ANGELES	~1 HR	~15 FT	Not Available	Not Available
WHIDBEY ISLAND- AULT FIELD	~1 HR 30 MIN	~4 FT	~1 HR	~<1 FT
PORT TOWNSEND- FERRY TERMINAL	~1 HR 40 MIN	~9 FT	~40 MIN	~3 FT
WHIDBEY ISLAND- CULTUS BAY	~2 HR 10 MIN	~2 FT	~ 25 MIN	~5 FT
EVERETT- NAVAL STATION	~2 HR 15 MIN	~<1 FT	~ 30 MIN	~2 FT
BELLINGHAM-ZUANICH POINT PARK	~2 HR 15 MIN	~5 FT	~1 HR 45 MIN	~<1 FT
SEATTLE- GREAT WHEEL	~2 HR 20 MIN	~2 FT	MINUTES	~27 FT
BANGOR- SEAWOLF RD	~2 HR 30 MIN	~9 FT	~45 MIN	~4 FT
TACOMA- PORT OF TACOMA	~2 HR 40 MIN	~4 FT	~ 20 MIN	~5 FT
BELFAIR- BELFAIR STATE PARK	~ 3 HR 30 MIN	~6 FT	1 HR 40 MIN	~3 FT
OLYMPIA- PERCIVAL LANDING PARK	~4 HR 15 MIN (MAX HEIGHT AT 10 HR)	~2 FT	~ 1 HR 15 MIN	~<1 FT

# Tsunami Inundation Map

Detailed inundation maps

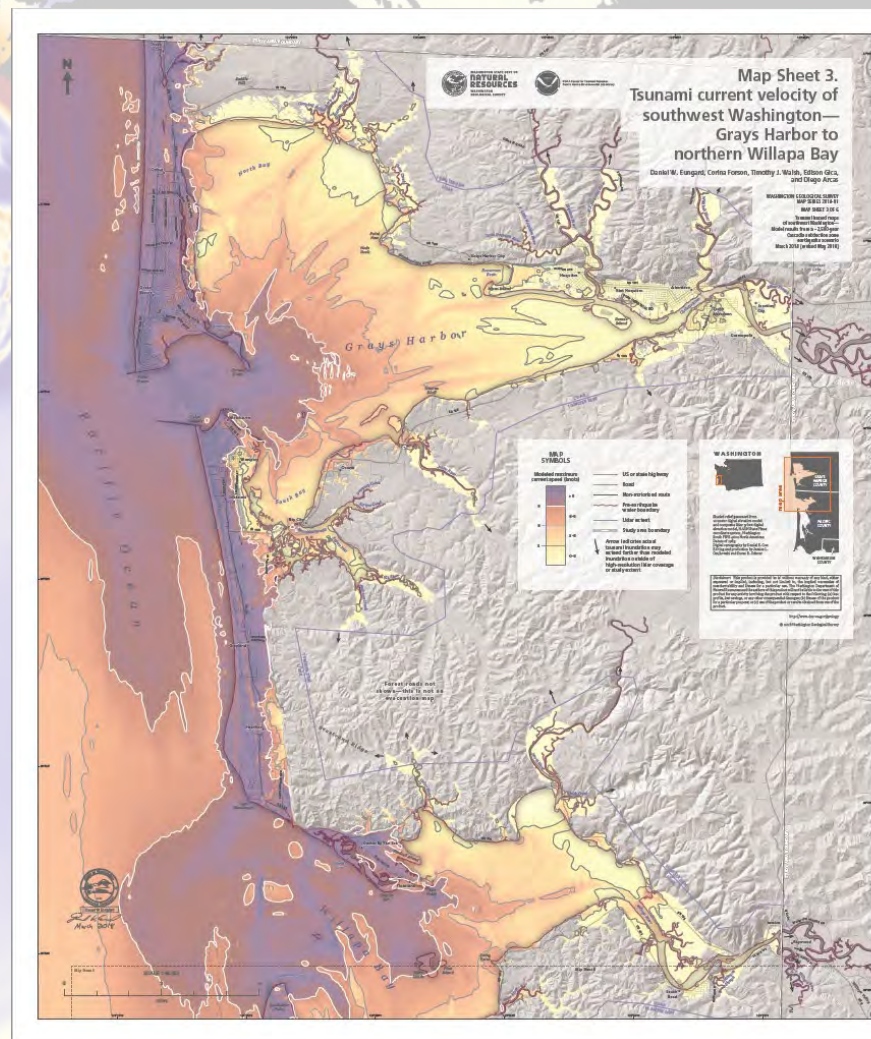
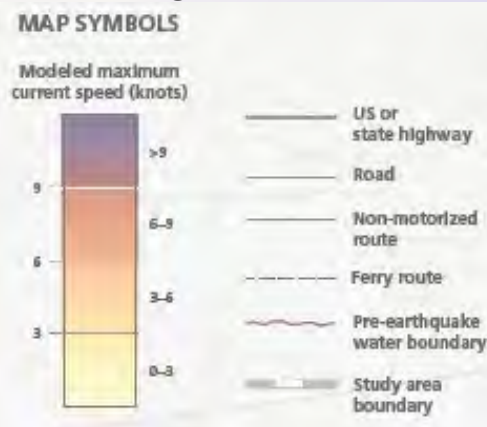
- Wave arrival times
- Inundation depths
- Land use planning/mitigation measures



# Tsunami Current Velocity Map

## Current velocity maps

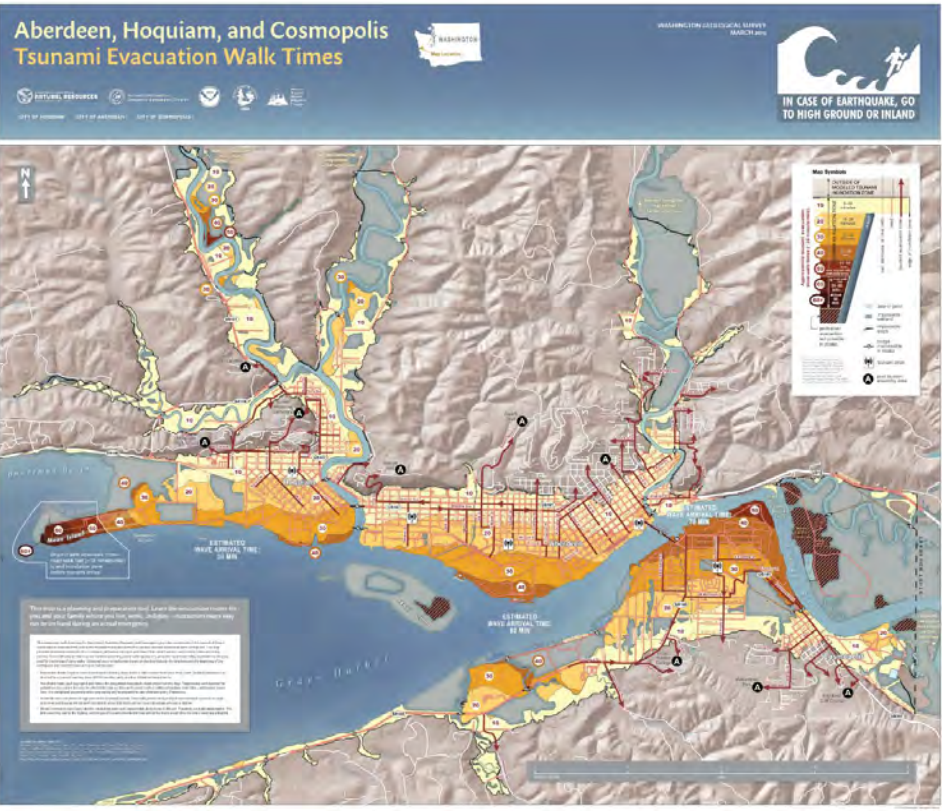
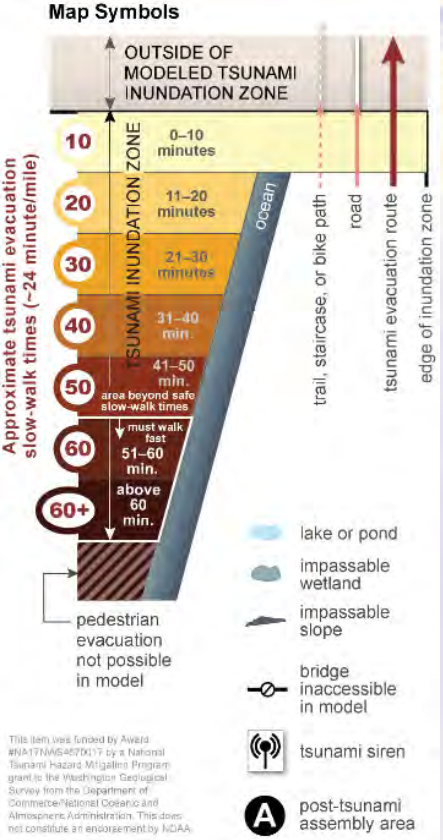
- Important for maritime guidance
- > 9 knots = extreme risk to ships, port infrastructure unlikely to survive
- < 3 knots = minimal risk
- 3-9 knots = minimal to high risk



# Tsunami Evacuation Walk Times Map

## Pedestrian evacuation maps

- Time to evacuate
- Fastest route out of inundation zone



# Upcoming Tsunami Hazards Publications for 2021

- CSZ inundation and current velocity for the Puget Sound and adjacent waters (early 2021)
- Seattle fault inundation and current velocity for the Puget Sound and adjacent waters
- CSZ inundation for the northwest outer coast
- Walk maps (4 proposed areas)
- Simulation videos (3 proposed areas)






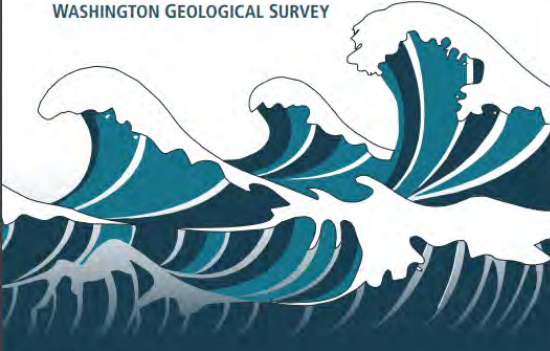
# Tsunami Hazards Brochure

GEOLOGIC HAZARDS IN WASHINGTON STATE

## Tsunami Hazards in Washington State



WASHINGTON GEOLOGICAL SURVEY



**WHAT IS A TSUNAMI?**

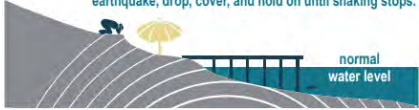
A tsunami is a series of waves most commonly caused by an earthquake beneath the seafloor. As tsunamis enter shallow water near land, they increase in height and can cause great loss of life and property damage.

Tsunamis have struck the Washington coast in the past and will do so again. They can occur at any time of the day or night, under any and all weather conditions, and in all seasons.


**If you feel an earthquake and you're near the water, get to high ground!**

6 **KNOW WHEN AND WHERE TO RUN**

Feeling an earthquake or hearing a loud roar coming from the ocean could be your only warning for an incoming tsunami. If you feel an earthquake, drop, cover, and hold on until shaking stops.

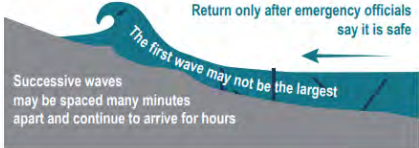


normal water level



Water may or may not recede before a tsunami

Move to higher ground immediately!




Return only after emergency officials say it is safe

The first wave may not be the largest

Successive waves may be spaced many minutes apart and continue to arrive for hours

**WHAT DO THE EVACUATION SIGNS MEAN?**



Ideally, you should know the evacuation routes for your area ahead of time. If not, evacuation signs along many roads also point toward higher ground. There may be multiple routes to reach safety.

[www.dnr.wa.gov/geology](http://www.dnr.wa.gov/geology)

- [https://www.dnr.wa.gov/publications/ger\\_tsunami\\_hazards\\_brochure.pdf](https://www.dnr.wa.gov/publications/ger_tsunami_hazards_brochure.pdf)

# Tsunami Design Zones in the State Building Code

- Who: Washington State
- What: Adoption of a new building code focused on tsunami and engineering loads for newly constructed critical facilities and Vertical Evacuation Structures
- Where: Tsunami inundation zones
- When: February 2021



## Tsunami Loads and Effects

Guide to the Tsunami Design Provisions of ASCE 7-16

San N. Robertson, Ph.D., E.C.

ASCE PRESS

The image is a screenshot of the 'ASCE Tsunami Hazard Tool' web application. The interface is divided into several sections. At the top, the title 'ASCE Tsunami Hazard Tool' is displayed in large white letters on a blue background, with the subtitle 'ASCE Tsunami Design Geodatabase Version 2016-1.0' to its right. Below the title, there are three main sections: 1. 'Enter Structure Information' which includes a search bar with 'Enter Location' and options for 'ADDRESS', 'LAT/LONG', and 'FIND ON MAP'. A 'SEARCH' button is present. 2. 'Select Criteria' which includes 'Tsunami Risk Category' (with a dropdown menu), 'Risk Category' (with a checked checkbox), 'Measurements' (with a checked checkbox), and radio buttons for 'Customary' and 'SI'. 3. 'Select Data Type for Analysis' which has tabs for 'DATA POINTS' and 'TRANSECT'. Below these tabs, there are instructions: 'Click on points [red triangle, blue square, blue circle] or DRAW A BOX over multiple [blue square] to view point data.' A note at the bottom states: 'Note: Offshore Tsunami Amplitude points may be some distance off-shore so zooming out may be required.' On the right side of the interface is a map of the United States and parts of Canada and Mexico, showing the Pacific Ocean to the west and the Gulf of Mexico to the east. The map highlights tsunami hazard zones along the West Coast of the United States.

# TsuInfo

TsuInfo Alert is a bi-monthly newsletter that links scientists, emergency responders, and community planners to the latest tsunami research.

Contact:

Stephanie Earls

[Stephanie.earls@dnr.wa.gov](mailto:Stephanie.earls@dnr.wa.gov)

360-902-1473

## TsuInfo Alert



TsuInfo Alert is a bi-monthly newsletter that links scientists, emergency responders, and community planners to the latest tsunami research. This newsletter is published by the Washington Department of Natural Resources, [Washington Geological Survey](#) on behalf of the [National Tsunami Hazard Mitigation Program](#), a state/federal partnership funded through the National Oceanic and Atmospheric Administration. It is made possible by a grant from NOAA's National Weather Service via the Washington Military Department, Division of Emergency Management. Contact [Stephanie Earls](#) to subscribe.

### ARTICLE SUBMISSION GUIDELINES

Have you recently published new tsunami mapping or research? Has your community just held a tsunami preparedness event or training? If so, please consider submitting an article to TsuInfo. Recommended length is 150-500 words with 1-2 images that include captions and/or photo credit if applicable. Please clearly state authorship and associated organization. Send articles or questions to TsuInfo Editor [Stephanie Earls](#).

[\[Read less\]](#)

▶ 2020

▶ 2019

# Geology Portal

<https://geologyportal.dnr.wa.gov/>

- Published products
- Access to geologic data
- Locational tools
- Print and save functions
- Use link above or type “WA Geology Portal” in your browser

The screenshot displays the Washington Geologic Information Portal interface. At the top, the portal's name and a search bar are visible. The main map area shows the Pacific Northwest coast of the United States, with various cities and geographical features labeled. Overlaid on the map are several colored polygons representing tsunami hazard areas: orange for Hazard Maps, blue for Evacuation Maps, and yellow for Evacuation Walk Maps. A 'Table of Contents' panel is open on the left, listing categories such as 'Tsunami Hazard', 'Mapped Hazard Areas', 'Unmapped Areas', 'Evacuation Routes', 'Assembly Areas and Shelters', 'Reference Points', 'Tsunami Sirens', 'Map Products', and 'Tsunami Scenarios Catalog'. A 'Legend' panel is also open, providing a key for the map's symbology. At the bottom, a scale bar indicates 40 km and 20 mi, and the current scale is 1:2,311,162. The coordinates are listed as Lat: 46.5206 and Long: -128.1169.



# Thank You

[alex.dolcimascolo@dnr.wa.gov](mailto:alex.dolcimascolo@dnr.wa.gov)

360-742-7571

# Maritime Tsunami Hazards



**Jacob Witcraft – Washington Emergency Management Division**



# Maritime Impact in Tohoku (2011)



© Toshifumi Kitamura/AFP/Getty Images  
MarineTraffic.com

## Japan (local)

- 28,000 ships destroyed
- 319 ports destroyed
- Economic loss of \$3.9 Billion/day



## California (distant)

- \$100M in damage to 24+ harbors
- Some closed for up to a year, some have yet to recover



# Washington's Maritime Economy

- 31 ports at risk of tsunami damage including the ports of Seattle and Tacoma (4<sup>th</sup> largest container gateway in the US)
- Largest ferry system in the US
- 7 Coast Guard stations, 4 Navy bases
- 700+ fishing and seafood processing operations
- 400+ private marinas
- \$37+ billion maritime industry





# Tsunami Hazards for Harbors and Boaters

- **Strong and unpredictable currents**
- Sudden **water-level fluctuations** where docks and boats hit bottom, overtop piles, or are pushed on top of docks
- **Eddies/whirlpools**
- **Tsunami bores and amplified waves** swamping boats and damaging docks
- **Debris in the water**
- **Dangerous tsunami conditions can last 12-24+ hours** after first wave arrival, impacting boaters who take their boats offshore



# What To Do When a Local Tsunami Strikes

- On the water
  - Cease any activities immediately, free any bottom attachments
  - Dock your vessel and evacuate to high ground if you are able
  - If not, head vessel to beyond 100 fathoms
  - Be aware of other vessels around you
  - Avoid areas with potential for dangerous currents
- On Land
  - Evacuate immediately to high ground - *you do not have time to save your vessel and you could die trying!*

Earthquake  
Long or Strong?

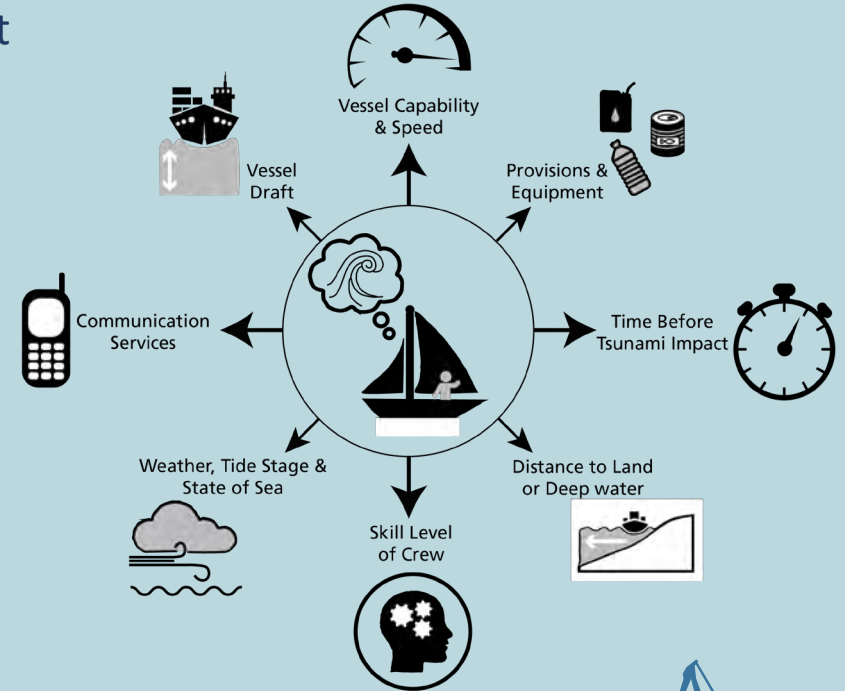


GET GONE



# What To Do When a Distant Tsunami Strikes

- On the water
  - Move to a location with a depth of at least 30 fathoms
  - Stay ½ mile from shoreline
  - Avoid areas with potential for strong currents
  - If a suitable location is not reachable in time, dock vessel and evacuate to high ground
- On land or tied to dock
  - Leave vessel and evacuate to high ground
  - Know your evacuation routes
  - Many distant source tsunamis are small enough to leave boat docked safely
  - Congestion in waterways and boat ramp areas can be dangerous






# What To Do After a Tsunami

- **Offshore:** Check with USCG for guidance before attempting to return
- **Onshore:** Check with local authorities for guidance before returning to inundation zone
- *Do not return to local ports until you have firm guidance from USCG and local authorities* - local ports/marinas may sustain heavy damage and may not be safe for days, weeks, or months



# What Can I Do To Prepare?

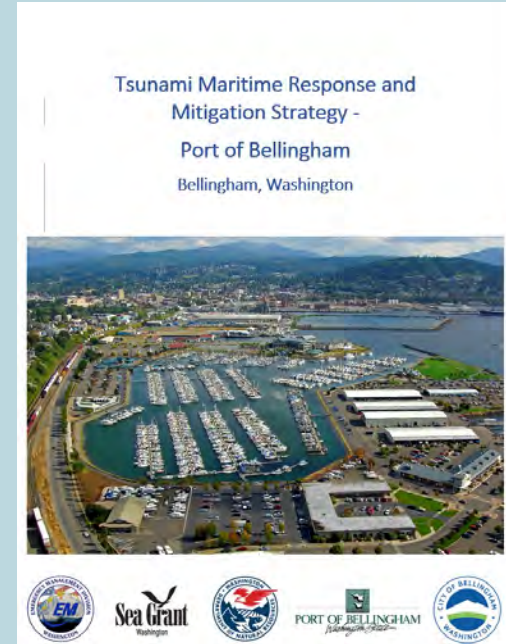
- Know the tsunami alert levels and have a NOAA Weather radio on your boat
- Have enough fuel and emergency supplies on vessel for at least 3 days at sea
- Know areas of dangerous currents to avoid and safe locations in open water

Tsunami Alerts		
Alert Name	Actions	Potential Hazards
 <b>WARNING</b>	Get to high ground or inland <b>IMMEDIATELY</b> Follow tsunami evacuation signage	<b>DANGER! TSUNAMI IMMINENT!</b> Flooding/powerful currents Wave heights > 3 ft. or unknown
 <b>ADVISORY</b>	Stay out of the water and away from the shore	<b>STRONG CURRENTS AND DANGEROUS WAVES</b> in or very near coastal water Wave heights of 1 - 3 ft.
 <b>WATCH</b>	Be prepared to take action Stay tuned to local radio/TV/ NOAA "alert" weather radios	<b>TSUNAMI IS POSSIBLE</b> Alert level <i>will</i> change once more information is known



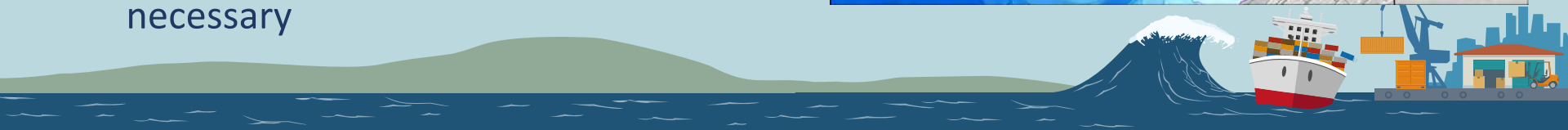
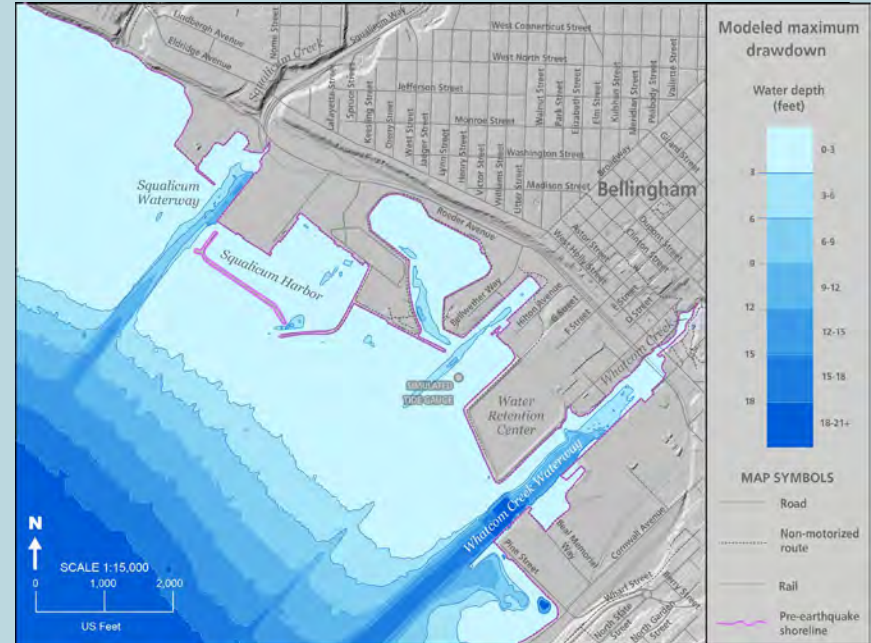
# What Can Ports and The Maritime Community Do To Prepare?

- Development of Maritime focused Response and Mitigation strategies
- Provides framework for Port/Harbor scale decision making
- Focuses on maritime infrastructure mitigation and response guidance for boaters and mariners



# What Does a Maritime Response And Mitigation Strategy Entail?

- Targeted port-area specific tsunami modeling
- Development of suite of maps detailing:
  - Inundation
  - Current velocity
  - Sea level drawdown
  - Evacuation routes
- Defining specific response roles to ensure appropriate and timely actions are undertaken when necessary



# Tsunami Preparedness



Elyssa Tappero – Washington Emergency Management Division





# Are YOU Prepared?

Can you answer these questions?

- How will I know a tsunami is coming?
- Do I know my evacuation routes, and have I practiced walking them?
- Do I have a family emergency plan?
- Do I have a go-bag ready?
- How will I communicate and reunite with my family?
- Am I involved in neighborhood and community preparedness?



Plan to be on your own for a while



# Supplies and Go-Bags

## At home (shelter-in-place)

- At least 2 weeks' worth of non-perishable food and water
- 1 gallon of water per person per day (for drinking, cooking, and cleaning)

## Go-bags (anywhere you spend time)

- Intended for immediate evacuation to high ground or a shelter
- One for each member of the family
- Have one at home, work, school, and in your vehicle

**Preparedness is:**

**Preparedness is *not*:**

Rather than scrambling when disaster strikes and supplies are short for everyone, buy a little bit extra on every trip.

EM  
WASHINGTON



# What's In Your Go-Bag?

The usual (food, flashlight, batteries, first aid kit, warm clothes, etc) but also...

- Water purification kit or tablets
- Portable NOAA radio
- Essential medications and medical equipment
- Copies of all important documents
- Cash
- Essentials for infants, the elderly, or pets
- Comfort items



# Think of Your Feet!

- After a nighttime earthquake, the #1 injury at emergency rooms is feet cut by broken glass and debris
- Keep the following in a bag tied to your bed:
  - Shoes
  - Flashlight with spare batteries
  - Warm jacket
  - Extra pair of glasses (if necessary)

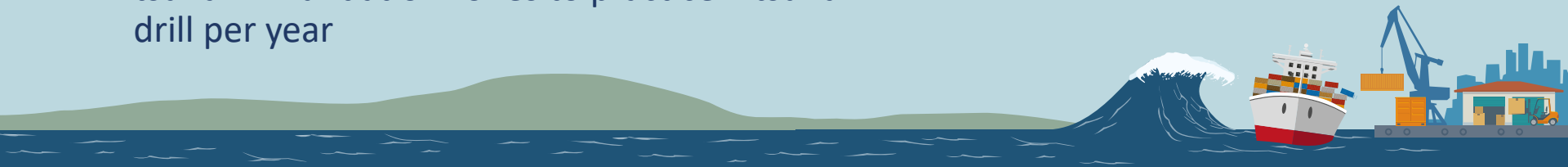
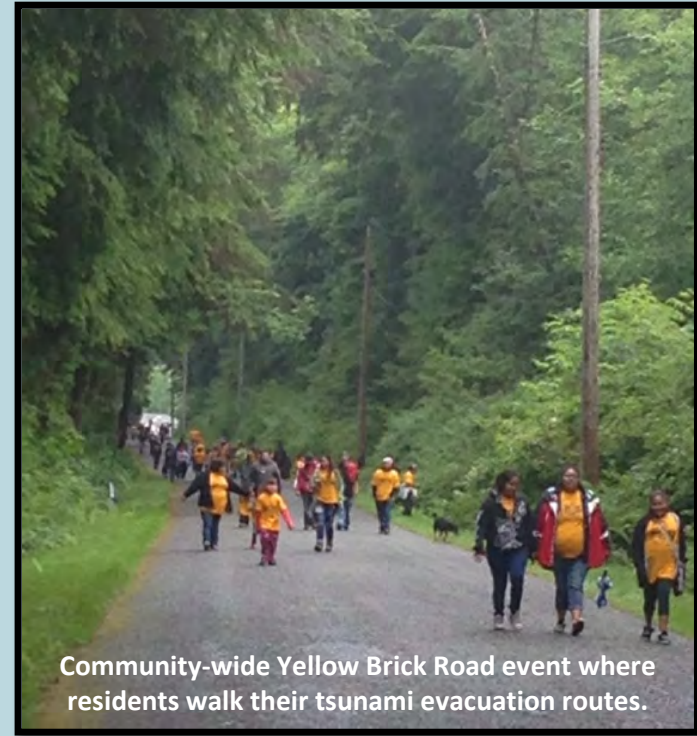


Find more tips like this at  
[DisasterReadyWashington.com!](https://www.DisasterReadyWashington.com)



# Evacuations

- Evacuating will take longer than you think!
  - Have your go-bag already packed and stored in an easily accessible place
  - Don't waste time confirming alerts with secondary sources or social media
  - Have a plan and practice, practice, PRACTICE!
- Washington laws
  - House Bill 1279 requires public schools to practice 1 earthquake drill per year
  - House Bill 1216 requires public schools in mapped tsunami inundation zones to practice 1 tsunami drill per year



# Stay Informed – Social Media & Apps

## National Tsunami Warning Center



NVS Tsunami Evacuation app for WA and OR (Apple & Android)

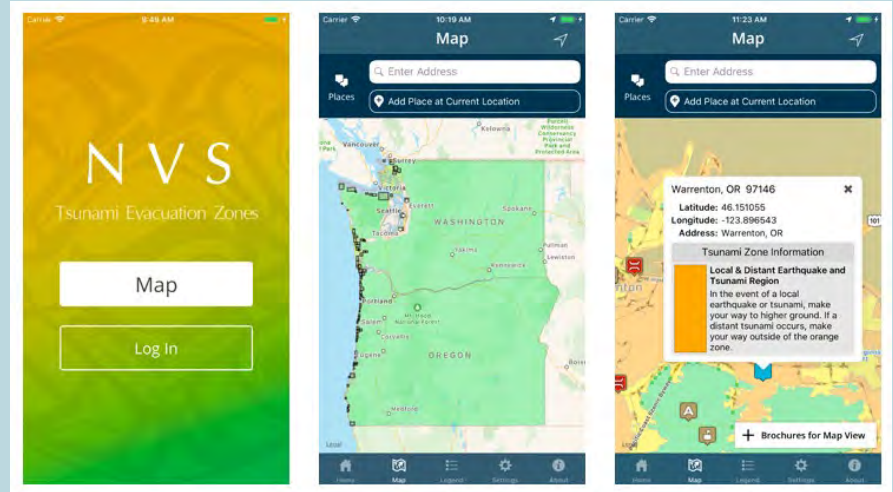
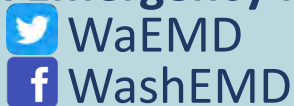
## National Weather Service Seattle:



## National Weather Service Portland:

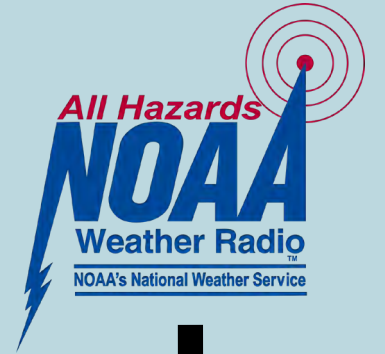


## WA Emergency Management Division:

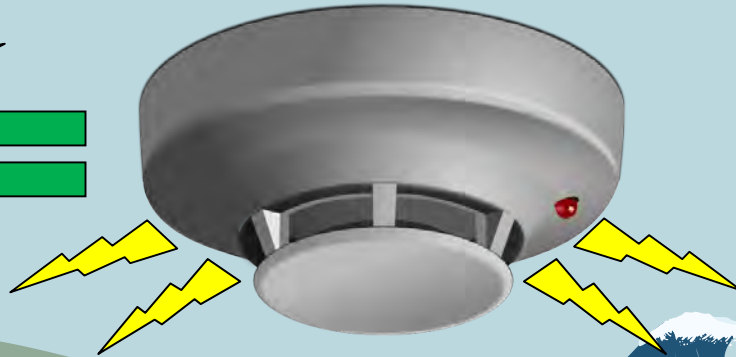
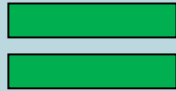


# Stay Informed – NOAA Weather Radio

- NOAA Weather Radio: nationwide network of radio stations broadcasting continuous weather information directly from NWS
- NOT just for tsunami alerts (e.g. winter storms, high winds)
- 16 Stations in Washington, must program the radio to your area
- Warning alarm feature acts just like a fire alarm
  - New models are programmed to only sound an alarm for a WARNING



Learn more at  
[weather.gov/nwr/](https://www.weather.gov/nwr/)





# Stay Informed – Local Alerts



→ Sign up for  
**LOCAL EMERGENCY ALERTS**

**MIL.WA.GOV/ALERTS**

to receive alerts for:

- ! imminent hazards
- ! immediate emergencies
- ! where to go
- ! what to do

Free to all people in Washington



# What if you were alerted when an earthquake occurred...

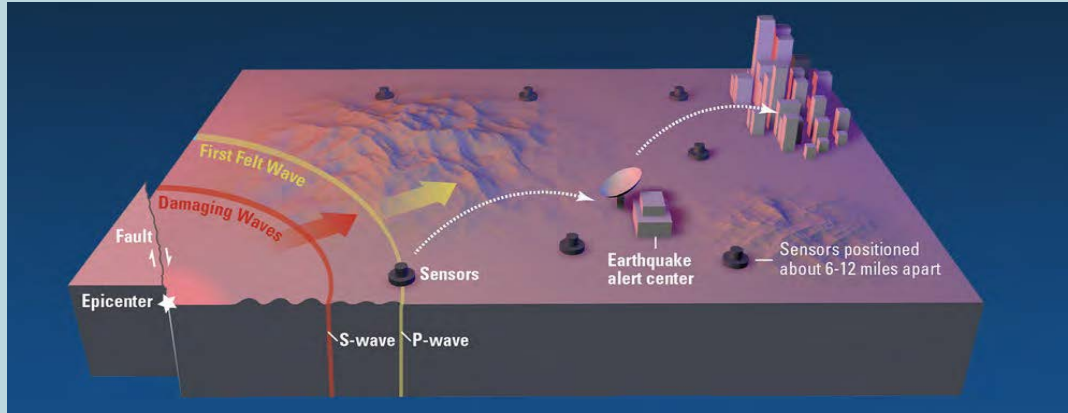


**BEFORE the shaking reached you?**



# Earthquake Early Warning is Coming!

The Earthquake Early Warning (EEW) System detects damaging earthquakes and rapidly disseminates alerts to people to warn them of imminent shaking.



WA state's goal is for EEW alerting to be available to the public starting in **2021** via WEA and mobile phone apps.



# “Re-Preparing” During the Covid-19 Pandemic

Since March, have you had to...

...use any of your emergency supplies?

...dip into your emergency savings fund?

...change any of your financial, medical, or insurance information?

...spend long amounts of time in new locations?

If so, it might be time to...

...review and restock!

...plan for replenishing it!

...save updated copies of your important documents!

...make new go-bags to store there!



[youtube.com/user/EMDprepare](https://www.youtube.com/user/EMDprepare)



# You CAN survive IF you get prepared!



[mil.wa.gov/alerts](https://mil.wa.gov/alerts)



[dnr.wa.gov/geologyportal](https://dnr.wa.gov/geologyportal)



[mil.wa.gov/preparedness](https://mil.wa.gov/preparedness)



[youtube.com/user/EMDprepare](https://youtube.com/user/EMDprepare)

If you have additional questions, please reach out to [public.education@mil.wa.gov](mailto:public.education@mil.wa.gov)

