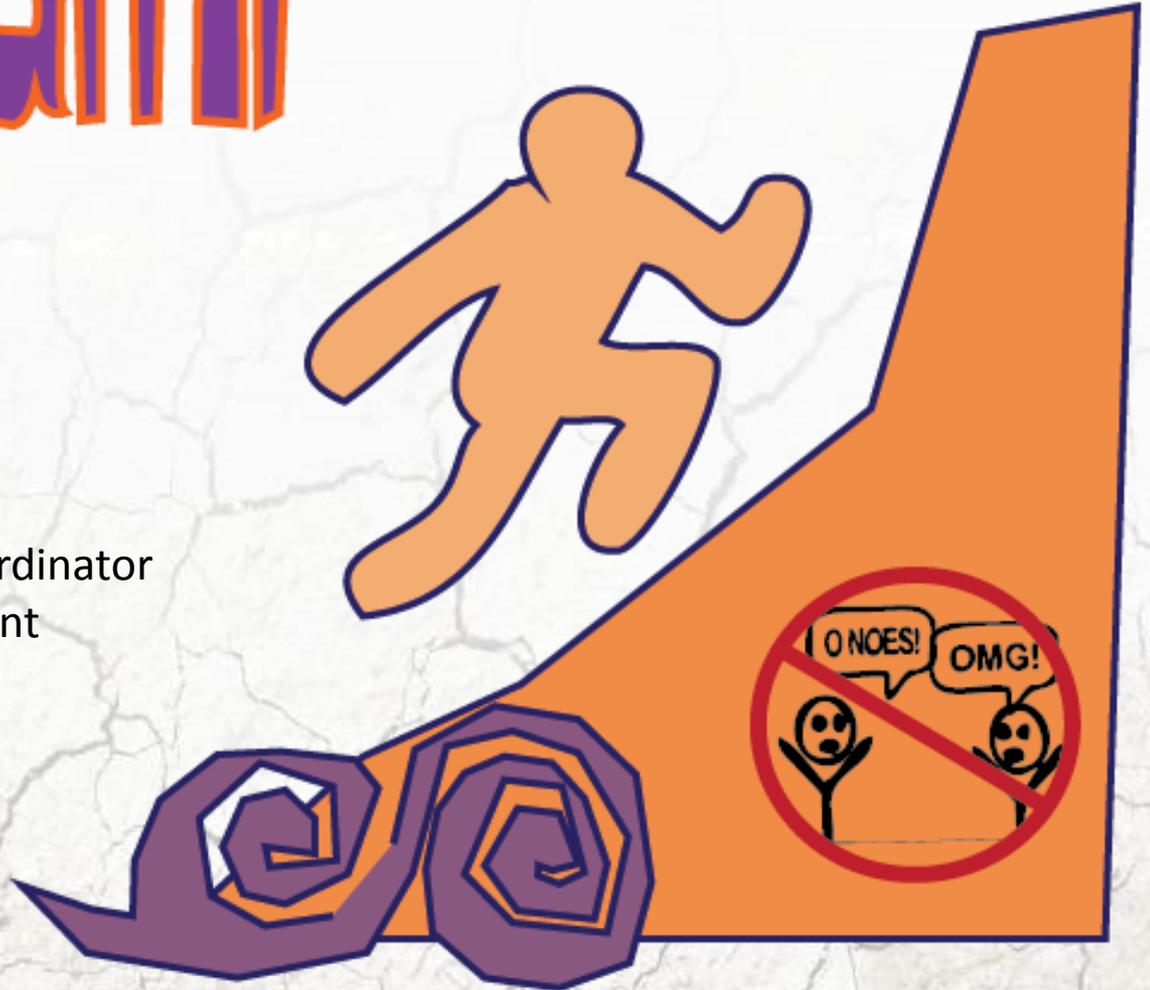


TSUNAMI PREP TALK

Althea Rizzo
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Why we're here talking about *earthquakes and tsunamis* ...



Getting from here to there ...

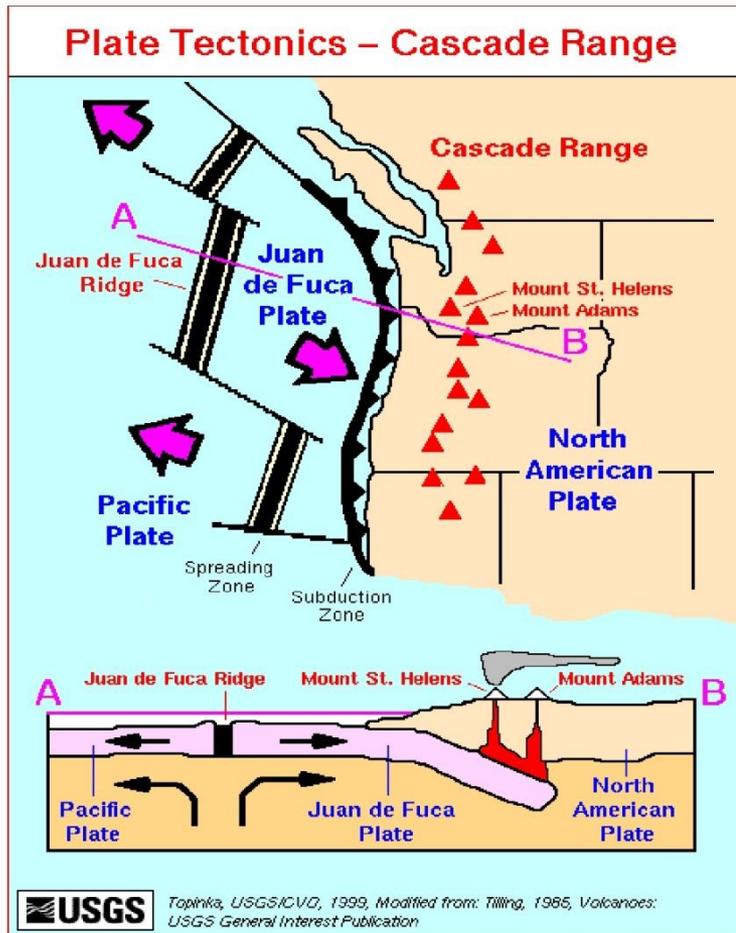


What we'll be talking about ...

- Cascadia Subduction Zone
- March 11 Japanese earthquake and tsunami
- Preparing your family
- Preparing your community
- Preparing you



Know your Cascadia Subduction Zone



- 600 miles long, from northern California to British Columbia
- Capable of producing very large earthquakes (M9+) that impact a wide area
- Similar in size and impact to the 2004 Sumatra earthquake
- Can produce devastating tsunamis



Know your Cascadia Subduction Zone



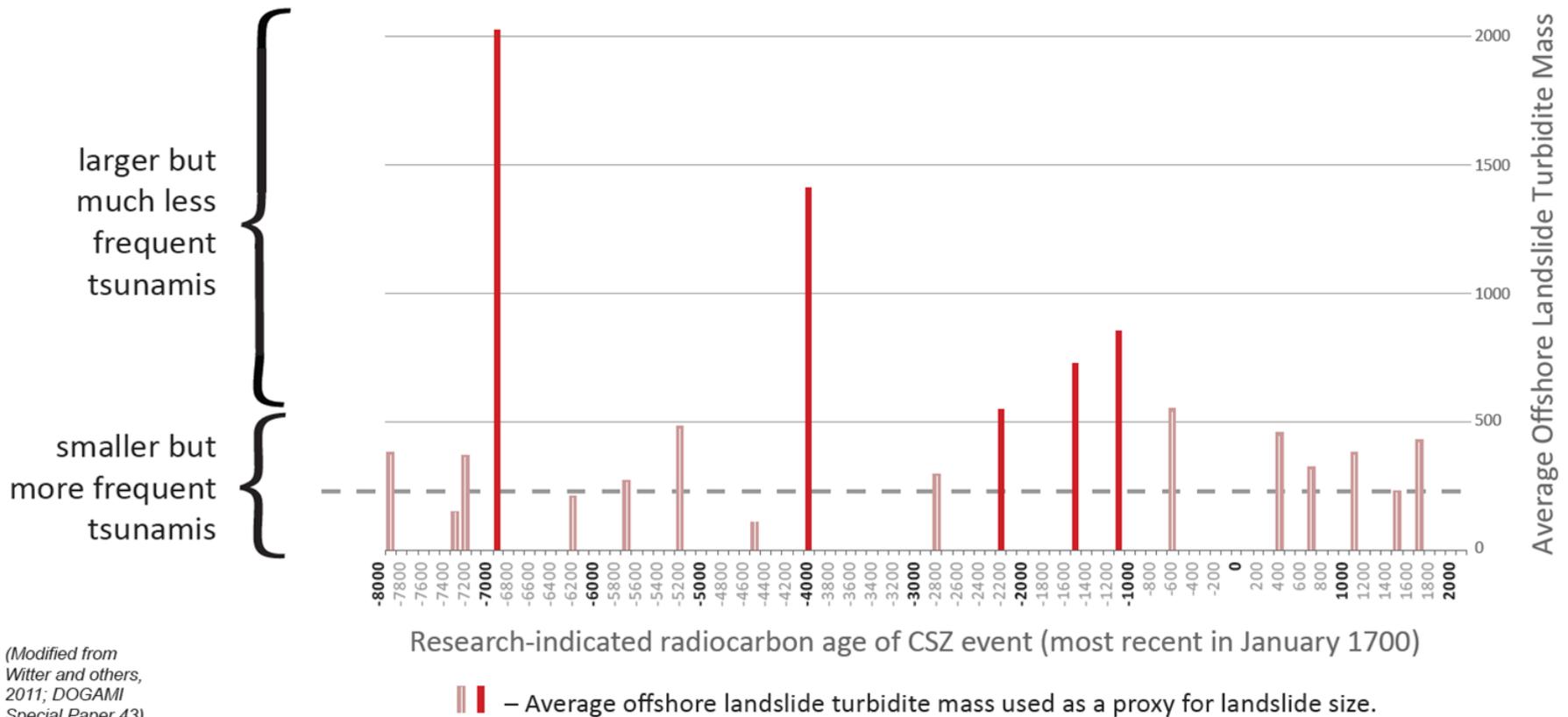
Ghost forest at Copalis River, WA

- Last Cascadia Subduction Zone earthquake occurred in 1700
- When will the next one occur?
 - We just don't know
- 37% chance of a mega-thrust earthquake in the next 50 years
- Average recurrence:
 - 240 years (south of Cape Blanco)
 - 5-600 years (entire length)
 - 190-1,200 years between EQ



But when will it happen again?

Occurrence and Relative Size of Cascadia Subduction Zone Megathrust Earthquakes



(Modified from Witter and others, 2011; DOGAMI Special Paper 43)



In the last 10,000 years...

**19 full
length
ruptures**

**22 partial
length
ruptures**

- Past 10,000 years
 - 19 earthquakes that extended along most of the margin, stretching from southern Vancouver Island to the Oregon-California border
 - 8.7 to 9.2 – really huge earthquakes.
- 22 additional earthquakes that involved just the southern end of the fault
 - slightly smaller – more like 8.0 – 8.2

We're in the Zone
And it WILL happen again

What are the hazards?

- ✘ Surface fault rupture
(Not common on land in Oregon)



2010 Canterbury, New Zealand



2009 Wenchuan, China



What are the hazards?

Strong ground shaking



2010 Haiti earthquake



2011 Tohoku earthquake



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What are the hazards?

Coastal subsidence



Mainichi Shimbun, Reuters

2004 Sumatra



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What are the hazards?

Landslides



Landslides in Ferndale, WA



2010 Taiwan



What are the hazards?

Liquefaction



1964 Alaska



2011 Christchurch, New Zealand



What are the hazards?

Tsunami



2004 Indonesian tsunami

2011 Tohoku tsunami



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Tsunami

- Local – Caused by a subduction zone earthquake near the Oregon shore
- Distant – Caused by a subduction zone earthquake far away from the Oregon shore



Distant Tsunami

- **Arrives 4 + hours after the earthquake**
- Lower damage and flooding than local tsunamis
- National Tsunami Warning System can warn you



Local Tsunami

- **Arrives minutes after the earthquake**
- Much higher waves
- Much further inland penetration
- NOAA Tsunami Warning System ineffective
- **Earthquake = Only Warning**



Tsunami Evacuation Maps

TSUNAMI EVACUATION MAP
CANNON BEACH AND ARCH CAPE AREAS, OREGON

IF YOU FEEL AN EARTHQUAKE:
• Drop, cover, and hold
• Move immediately inland to higher ground
• Do not wait for an official warning

SI USTED SIENTE EL TEMBLOR:
• Tírese al suelo, cúbrase, y espere
• Díquese de inmediato a un lugar más alto que el nivel del mar
• No espere por un aviso oficial

OUTSIDE HAZARDOUS AREA: Evacuate to this area for all tsunami warnings or if you feel an earthquake.

LOCAL CASCADE EARTHQUAKE AND TSUNAMI: Evacuation zone for a local tsunami from an earthquake at the Oregon coast.

DISTANT TSUNAMI: Evacuation zone for a distant tsunami from an earthquake far away from the Oregon coast.

ZONA DE PELIGRO EXTERIOR: Evacue a esta área para todos los alertamientos del maremoto o si usted siente un temblor.

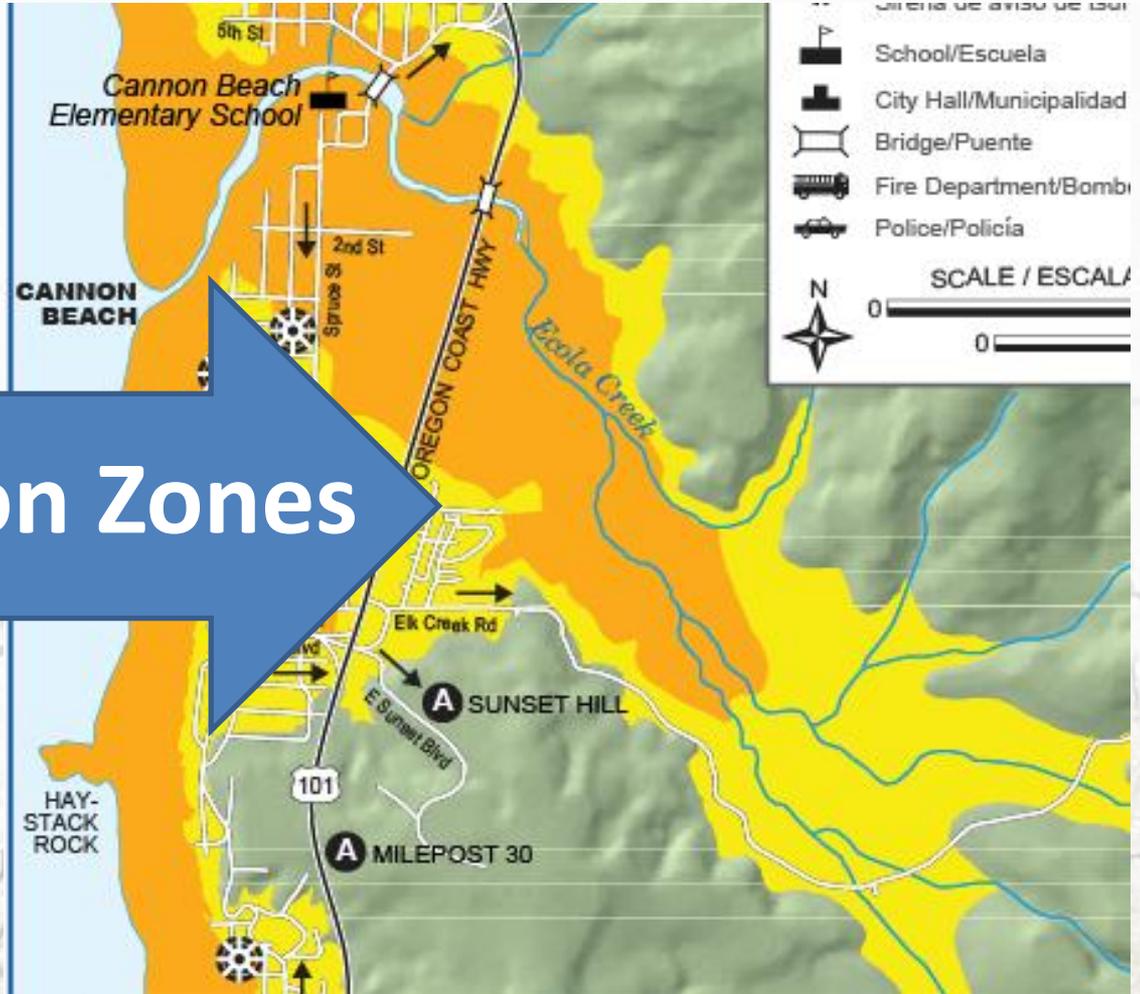
MAREMOTO LOCAL (terremoto de Cascadia): Zona de evacuación para un tsunami local de un temblor cerca de la costa de Oregon.

MAREMOTO DISTANTE: Zona de evacuación para un tsunami distante de un temblor lejos de la costa de Oregon.

MAP SYMBOLS / SIMBOLOS DEL MAPA

- Evacuation route / Ruta de evacuación
- Assembly area / Área reunión
- Tsunami warning siren / Sirena de aviso de tsunami
- School / Escuela
- City Hall / Municipalidad
- Bridge / Puente
- Fire Department / Bomberos
- Police / Policía

SCALE / ESCALA
0 0.5 mile / 0.5 km



Two Evacuation Zones

TOLOVANA PARK

HAYSTACK HEIGHTS

TOLOVANA MAINLINE

SILVER POINT

ARCH CAPE

HAEMLOCK ST

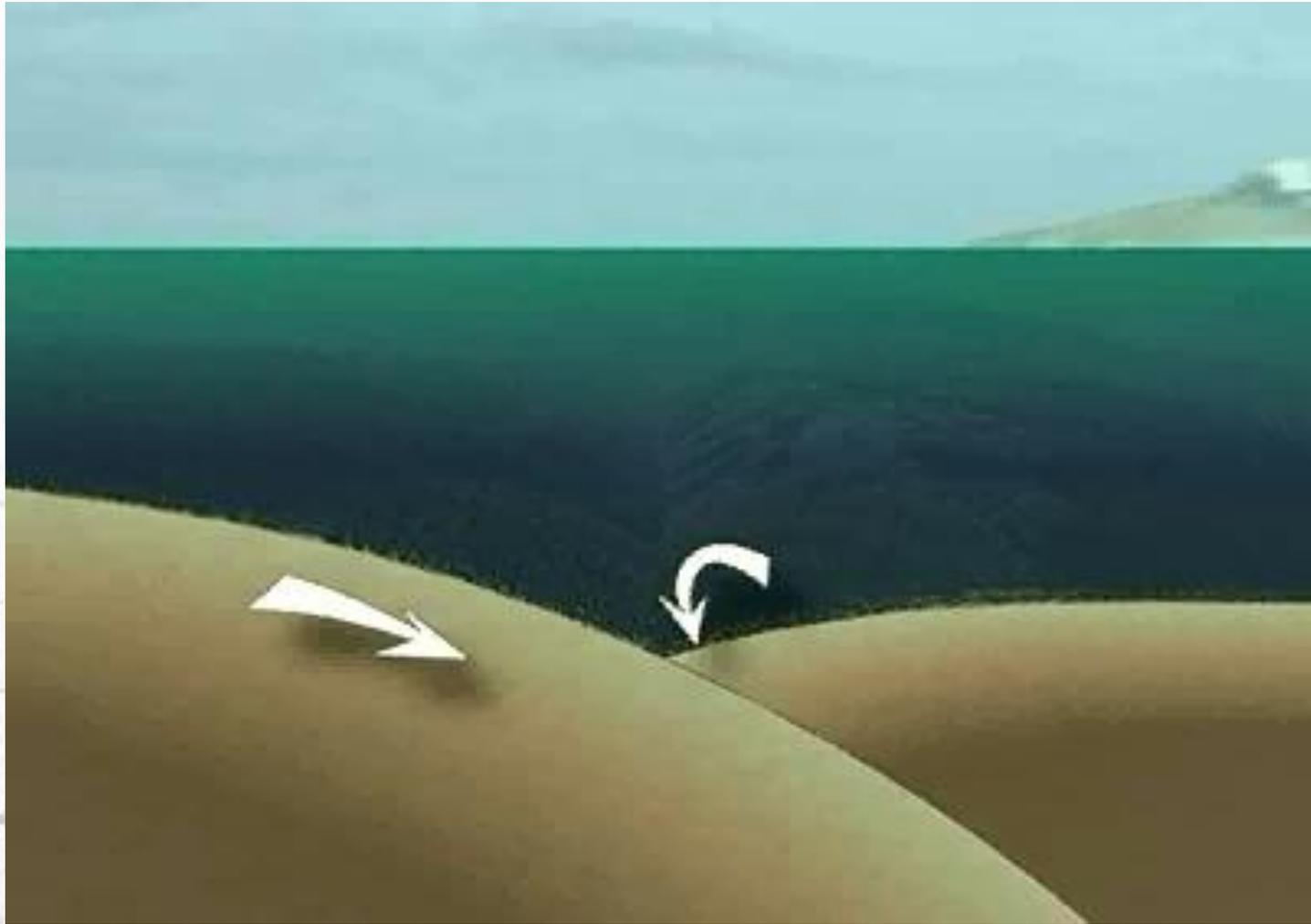
SANT PETER'S

FIRE ROCK RD

NOTICE:
This tsunami evacuation zone map was developed by ODEP and the Oregon Department of Emergency Management (ODEM) in partnership with the Oregon Coast Community College (OCCC) and the Oregon Coast Community College District (OCCD). The map is intended to provide information to the public and is not a guarantee of safety. The map is not intended to be used as a basis for any legal action. The map is not intended to be used as a basis for any legal action. The map is not intended to be used as a basis for any legal action.



What causes a tsunami?



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Why is there more than one wave?



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Tsunami Inundation



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What you really need to know about a tsunami

- Three Things

- It is a series of waves

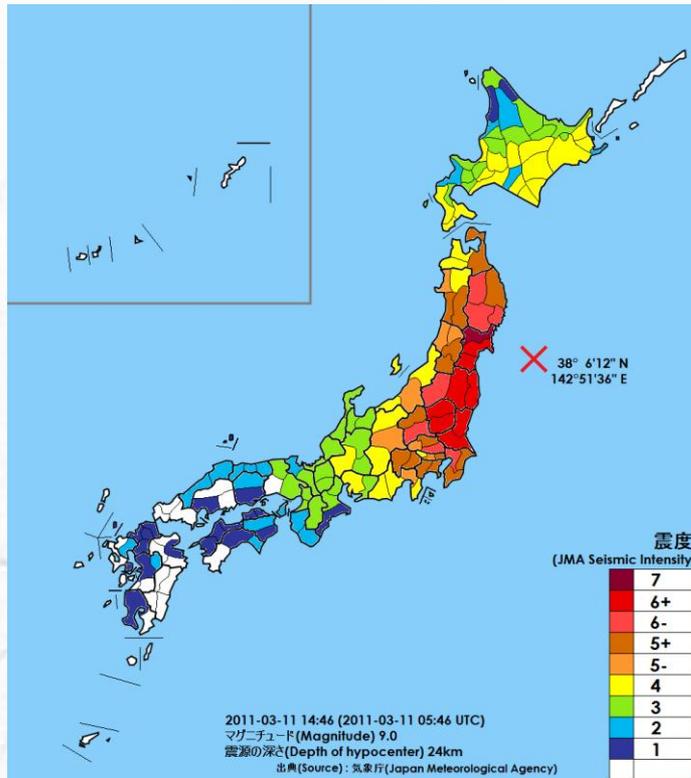
- Stay away for 24 hours

- Even small tsunamis can cause damage



March 11, 2011

Tohoku-oki Earthquake and Tsunami



Seismic Intensity Map



Locating Lost Family and Friends



Know your hazard

Probability versus Possibility

- Planning assumptions led to inadequate mitigation
 - (Probable) Response planning was based on recurrence of the 1896 to Meiji Sanriku or 1960 Chile tsunamis.
 - (Possible) 869 Jogan earthquake and tsunami
 - Significantly larger,
 - Geologic evidence for Magnitude 9 EQ/tsunami ignored
 - Viewed as an “outlier,” a 1,000-year event - low probability.
 - Planning scenario based on “100-year event.”



Human impact

- 22,600 persons killed or missing nationwide
 - 15,500 confirmed deaths
 - 92.4% drowning
- 107,000 buildings collapsed, and another 111,000 partially collapsed
- BUT
 - 6.5 million people live within 200 miles of rupture zone



Instant Automated Earthquake Magnitude Too Small but Fit Expectations

- 1st magnitude = 7.9
- Underestimated tsunami
- 2nd and 3rd magnitudes = 8.9, 9.0
- EQ damage causes no updated tsunami warnings



Factors affecting survival of tsunami

- Physical factors
 - geography and topography
 - distance to high ground
 - pre-disaster land use



Factors affecting survival of tsunami

- Human factors
 - time of the event
 - limited mobility
 - care giving behavior
 - past experience w. small tsunamis (always more frequent than big ones)
 - instinct to protect property



Survival factors: Preparedness + “Herd Instinct”

- Regularly practiced drills
- Follow other people evacuating



Prepare your community ...

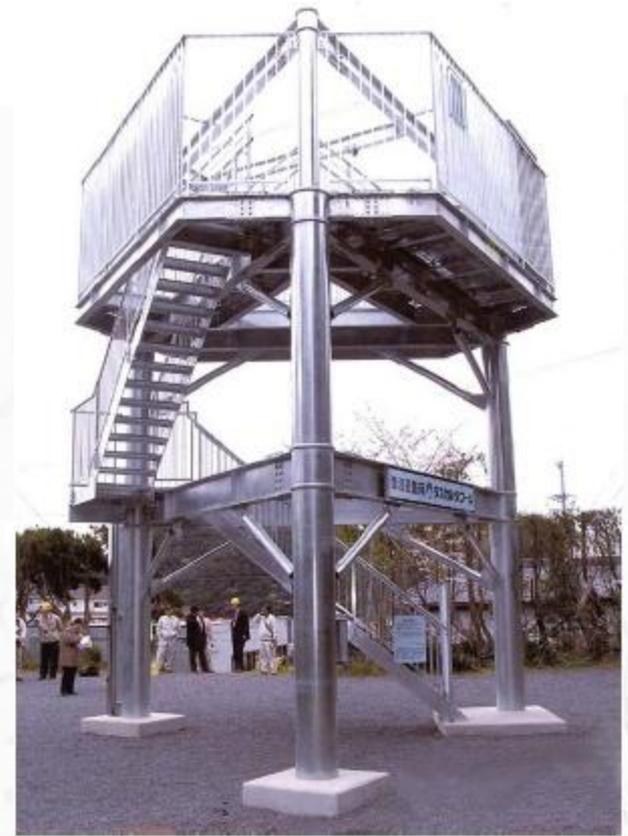


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Recommendations

- Enhance evacuation routes
 - Harden infrastructure
 - Clear way finding – night or day
 - Practice, practice, practice
- Build vertical evacuation refuges where high ground is not available.



Embed tsunami information in ambient built environment



R. Wilson



Cascadia Planning Assumption

- Magnitude 9+ earthquake probable
- Three metropolitan cities in impact zone
 - Portland
 - Seattle
 - Vancouver, B.C.
- Heavy urbanization along the I-5 corridor
- Approximately 9.5 million people live in the hazard zone in WA & OR



Responders as victims

- Lost political and response personnel,
 - Emergency Facilities destroyed.
- Otsuchi
 - Lost mayor, seven senior staff, and 31 other municipal employees in the tsunami.
- Minami Sanriku
 - Emergency operations and tsunami warning center was destroyed. 10 staff members survived by clinging to antennas on the roof.



Minami Sanriku
Tsunami Warning
Center

Recommendations: Ensure Critical Continuity

- Relocate critical facilities out of inundation zone
- Retrofit critical facilities
- Prohibit building new critical facilities in inundation zone (already the law in Oregon – SB379)
- Construct critical facilities to meet the most robust standards



Emergency Shelter and Housing

- About 470,000 Japanese required shelter
- Local governments provides care and sheltering.
- National government only assists.



Challenges to sheltering in Japan

- Local government officials and facilities did not always survive.
- Pre-designated shelters destroyed.
- Food and water delayed up to three days.
- Sheltering - mix of planned and ad hoc



In-place sheltering

- Family or friends or own homes
- Local shelters (can be a barrier to finding folks).
- Lifelines (power, water, sewage, gas) lacking for weeks.

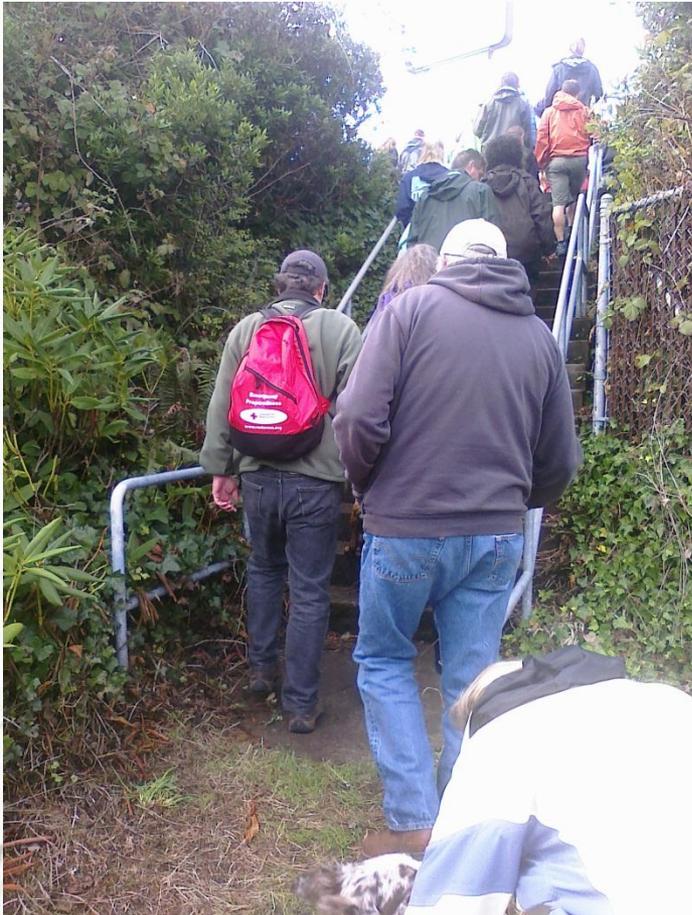


Recommendations

- Plan robust sheltering
- Bring the message home
 - Personal prep
 - Neighborhood prep
 - Community prep



Prepare your family ...



Assumptions

- Will be at home/work
- Will be able to get home/work
- Will know what to do
- Will have emergency plans/supplies



Great Oregon ShakeOut

**October 17, 2013
10:17 am**

1
DROP!

2
COVER!

3
HOLD ON!

**Get Ready to
Shake
Out**
shakeout.org/



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You can't prevent an Earthquake, but you can prepare for one

Building a culture of prevention is not easy because the cost of prevention has to be paid in the present, while its benefits lie in the distant future. Moreover, the benefits are not tangible; they are the disasters that did not happen. *(to paraphrase Kofi Annan)*



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