
Althea Rizzo

Oregon Office of Emergency Management

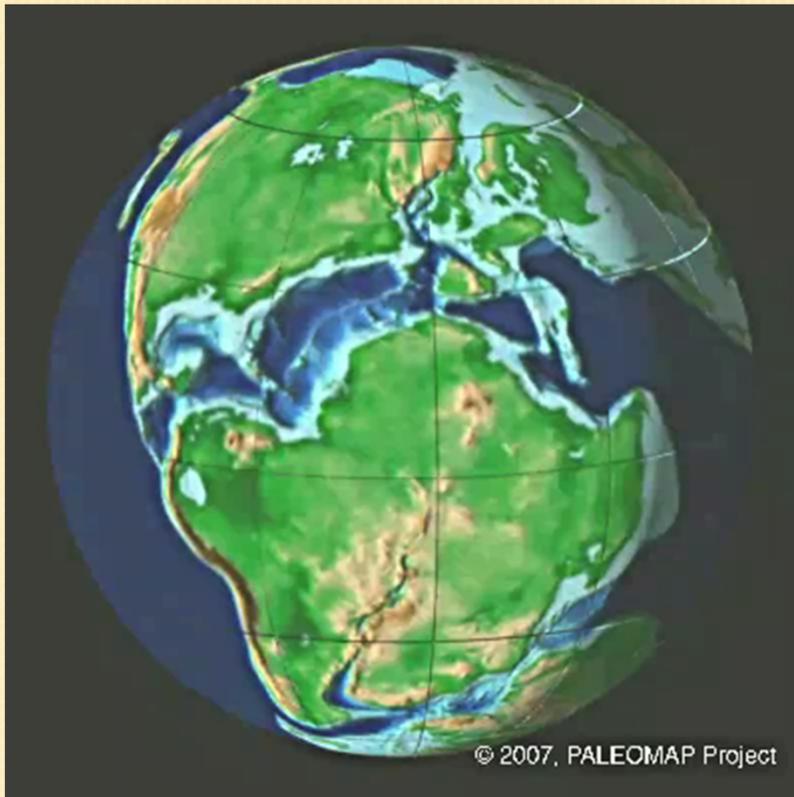
...or How I stopped worrying and learned to love
the ...

CASCADIA SUBDUCTION ZONE

WE WALK IN BEAUTY...



EVERYTHING YOU WANTED TO KNOW ABOUT PLATE TECTONICS...



- ✗ ... in 30 seconds or less
 - + Tectonic Plates move around
 - + Tectonic Plates spread apart and create new land
 - + Tectonic Plates dive under each other
 - + Tectonic Plates roll over each other

WHAT ARE THE GEOLOGIC HAZARDS IN OREGON?

- ✘ Earthquakes
- ✘ Volcanoes
- ✘ Tsunami
- ✘ Landslides



WHAT ARE THE GEOLOGIC HAZARDS IN OREGON?

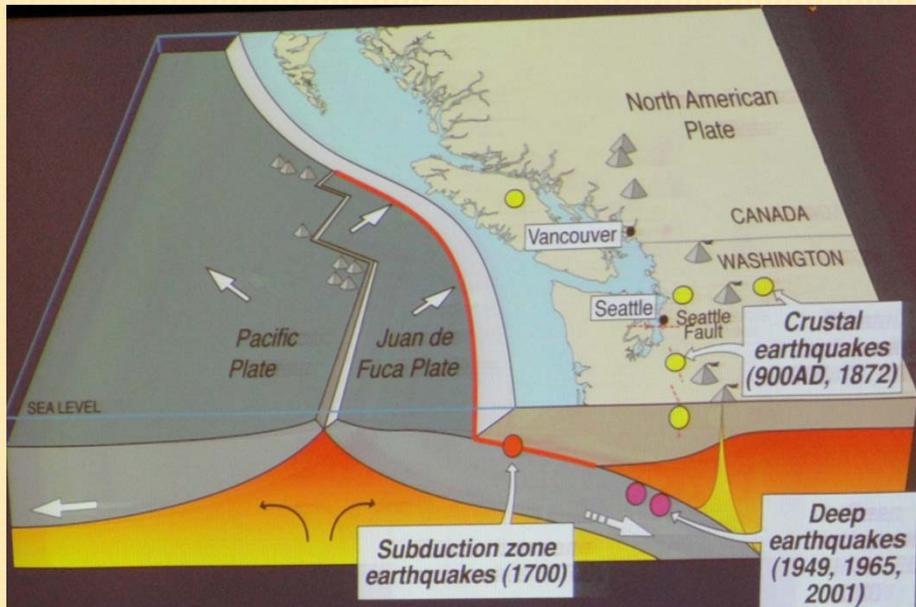
✘ Earthquakes

- + Cascadia Subduction Zone
- + Crustal
- + Deep Intraplate
- + Volcanic

✘ Tsunami

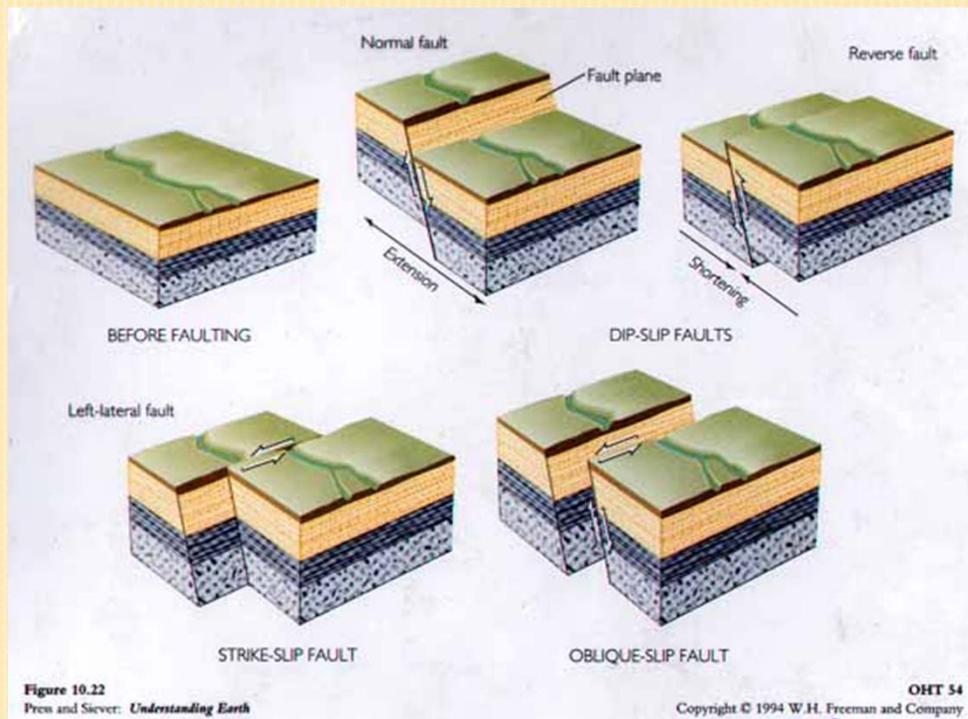
- + Local (from subduction zone off our coast)
- + Distant (from subduction zone elsewhere)

DEEP / INTRAPLATE



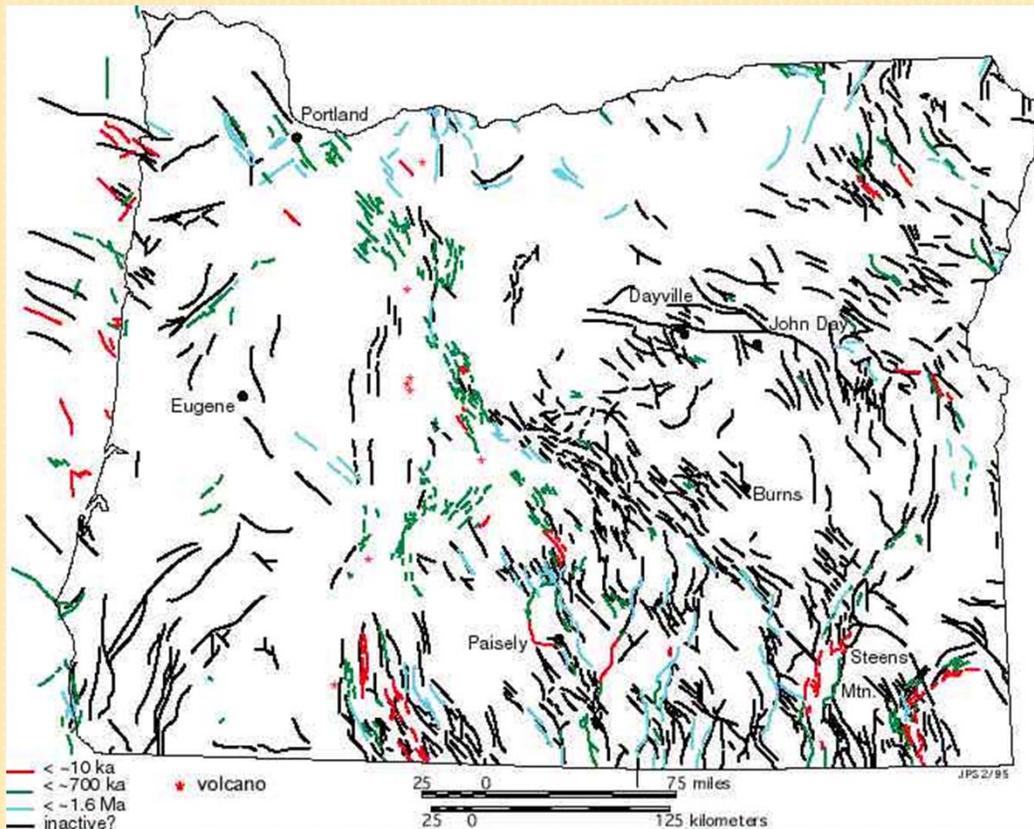
- Deep quakes are usually less than M7.5.
- The 2001 Nisqually, Washington quake (M6.8).
- Damaging deep earthquakes occur every 10-30 years.
- The seismic energy disperses over a much larger area. Damage is usually less than in a similar sized shallow quake.
- Few, if any, aftershocks occur.
- No tsunami expected, although landslides could trigger local tsunamis.

SHALLOW / CRUSTAL



- ✘ Aftershocks are common and may cause further disruption.
- ✘ No tsunami expected, although there could be a local tsunami from landslides.

SHALLOW / CRUSTAL



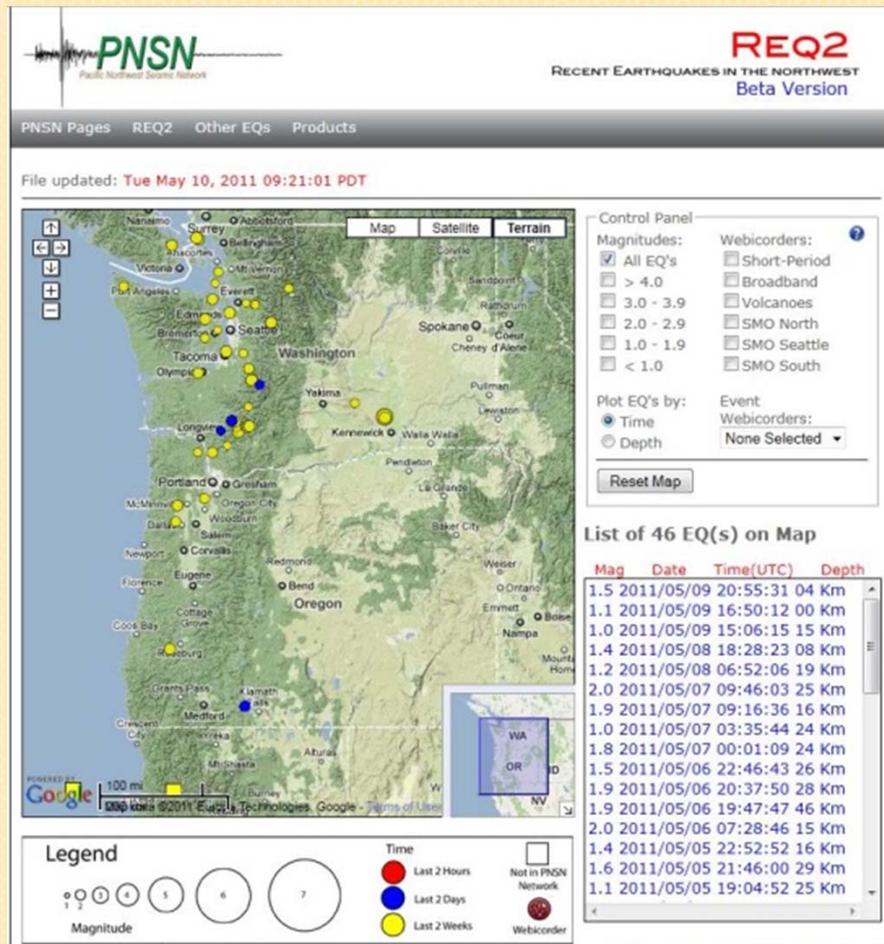
- ✘ Strong shaking is generally 20-60 seconds, although it could be longer in localized areas.
- ✘ Shallow quakes are usually less than magnitude (M) 7.4.

SHALLOW / CRUSTAL

✘ (Incomplete) List of magnitude 4.0 or larger earthquakes in Oregon

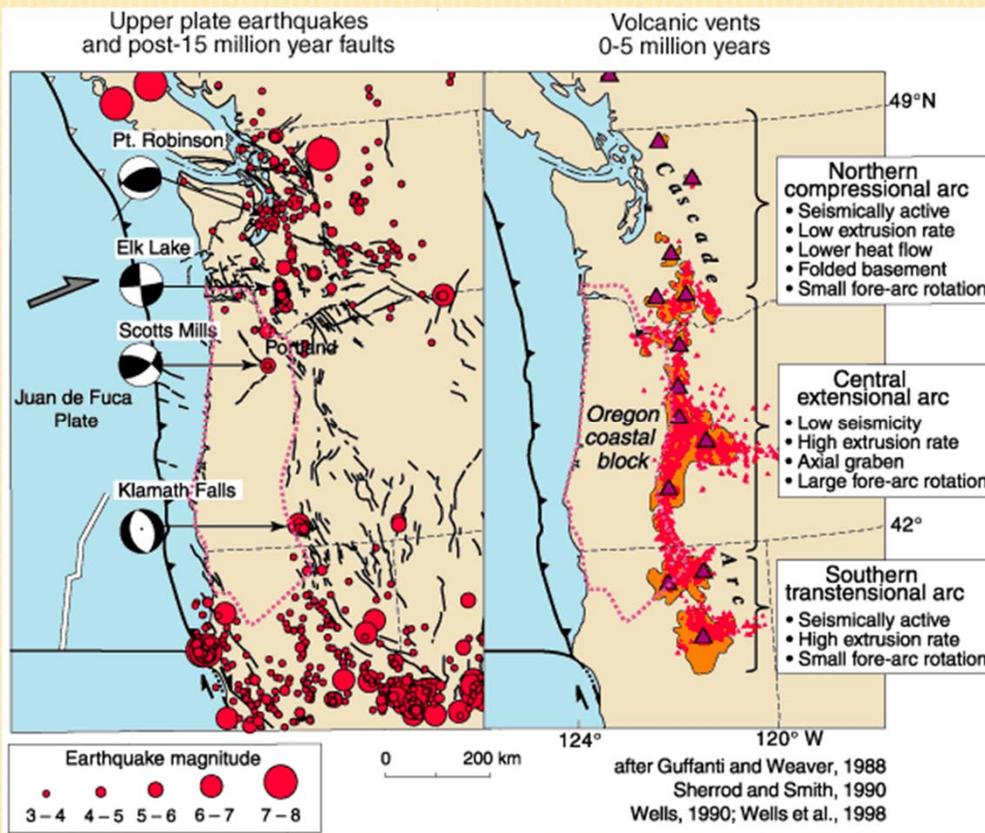
+ 1873	6.3	67.2 km SSW of Coos Bay, OR
+ 1930	5.0	14.5 km WNW of Salem, OR
+ 1936	6.1	8.1 km SSE of Walla Walla, WA (felt in OR)
+ 1941	5.0	0.0 km S of Portland, OR
+ 1957	5.0	17.7 km S of Tillamook, OR
+ 1965	4.3	67.3 km ENE of Baker, OR
+ 1968	4.6	9.1 km WNW of Adel, OR
+ 2009	4.1	48.2 km WNW of Grants Pass, OR

HAZARD – SHALLOW / CRUSTAL



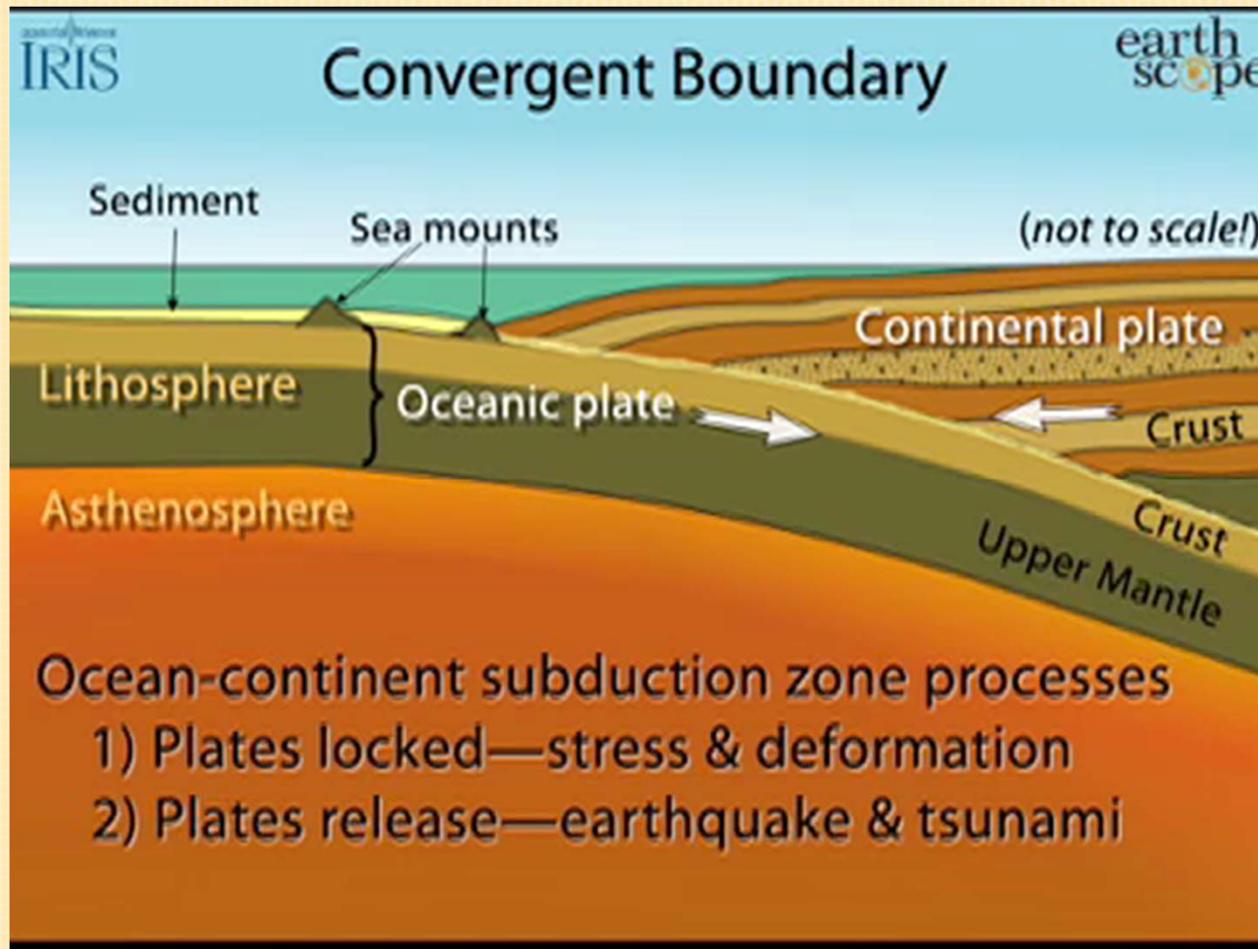
- ✘ <http://www.pnsn.org/req2/>
- ✘ Map showing earthquakes in last 48 hours
- ✘ Small shallow earthquakes are recorded every day in Cascadia; damaging quakes occur every few decades.

SHALLOW / CRUSTAL



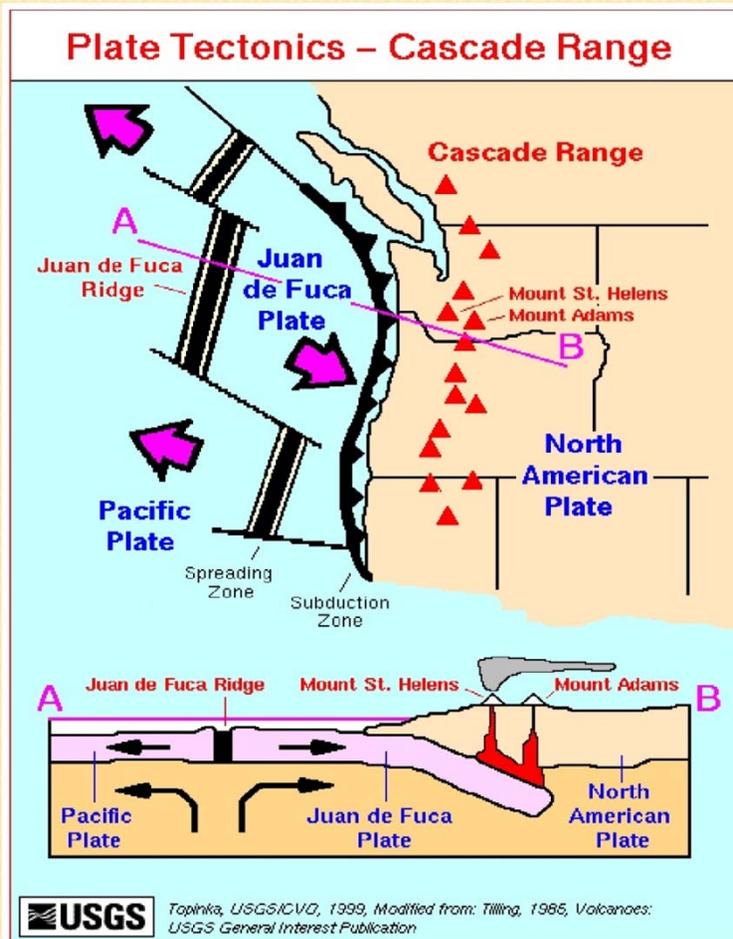
- ✘ Most crustal quakes are shallow, Klamath Falls (6.0) and Scotts Mills (M5.6) in 1993.
- ✘ Damage can be very heavy in the area of the epicenter and along the fault.

WHAT IS THE CASCADIA SUBDUCTION ZONE?



Source: http://www.iris.edu/hq/programs/education_and_outreach/animations/11

WHAT IS THE 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
- 10% chance of a mega-thrust earthquake in the next 50 years

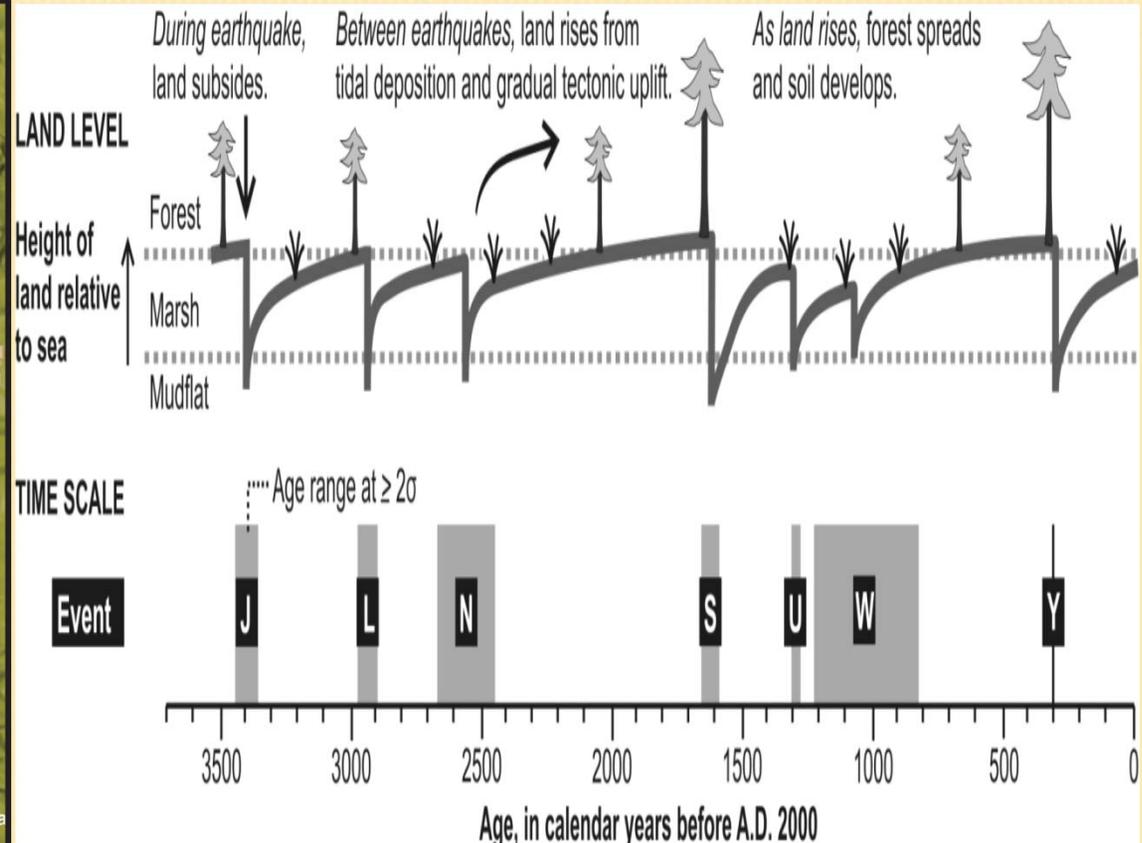
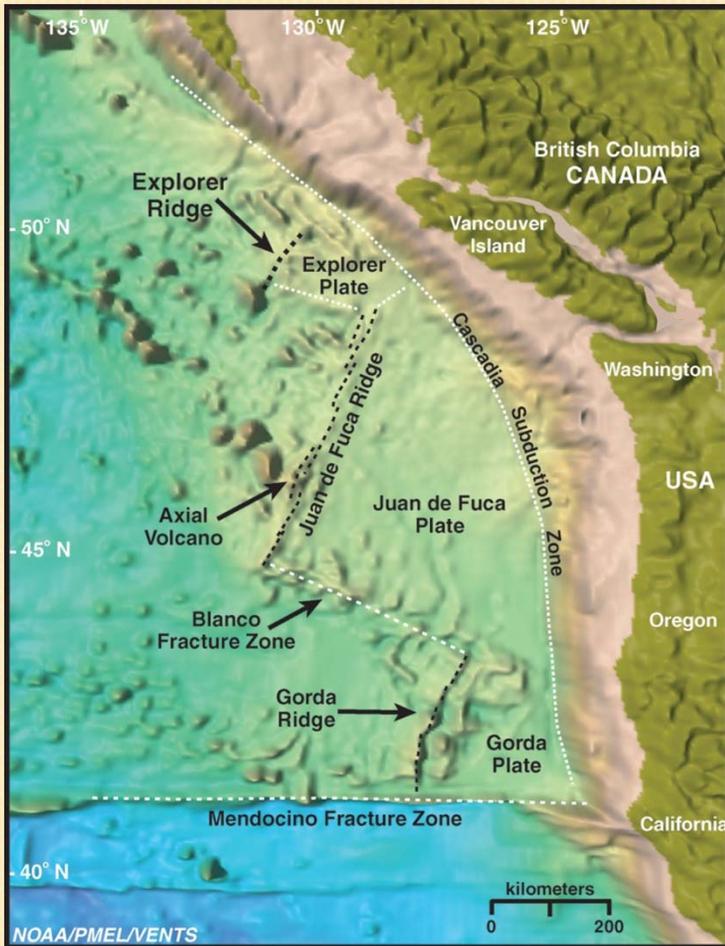
WHAT IS THE CASCADIA SUBDUCTION ZONE?



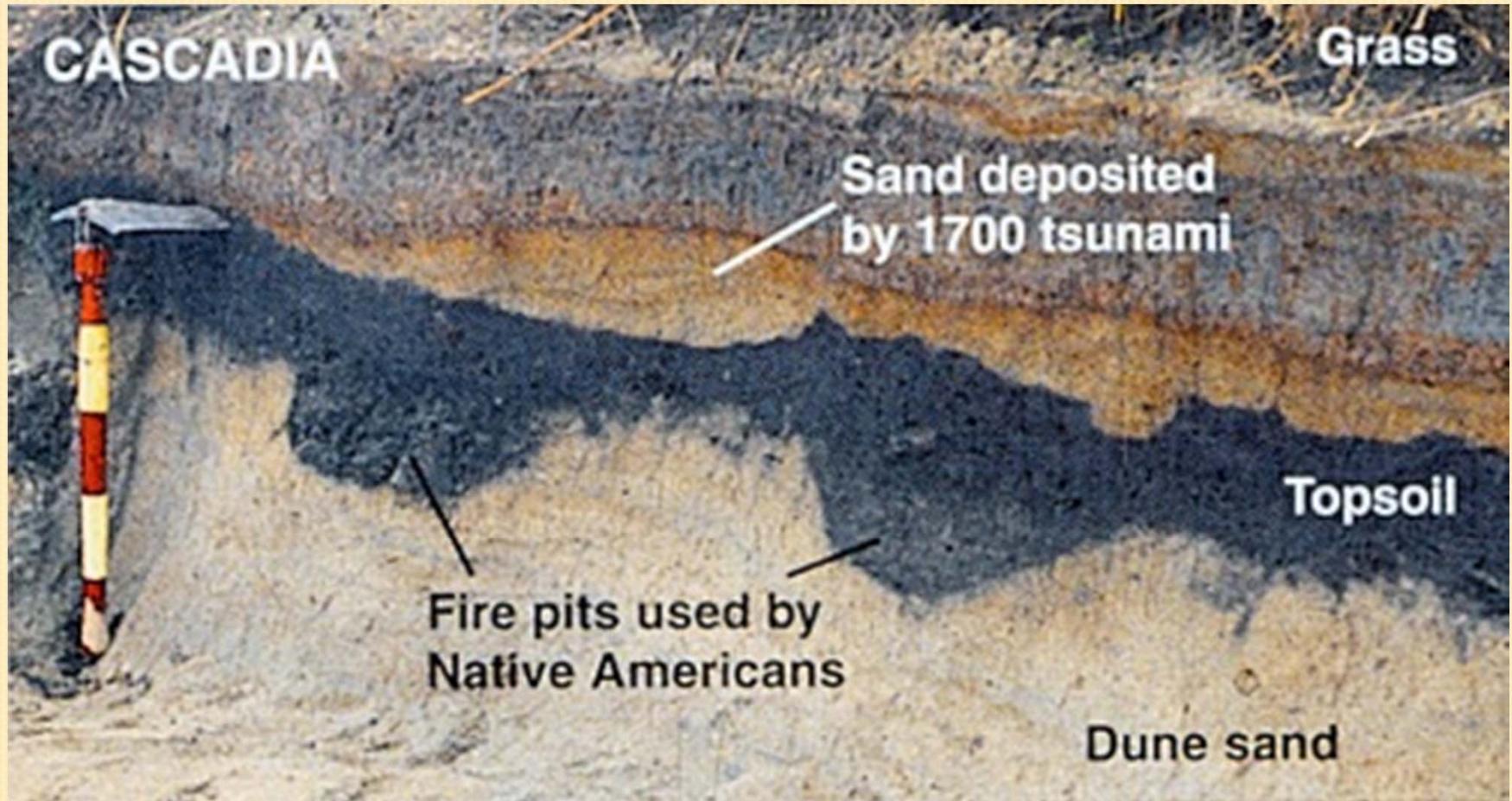
Ghost forest at Copalis River, WA

- ✘ Last Cascadia Subduction Zone earthquake occurred in 1700
- ✘ Average recurrence: 240 years

WHAT IS THE CASCADIA SUBDUCTION ZONE?

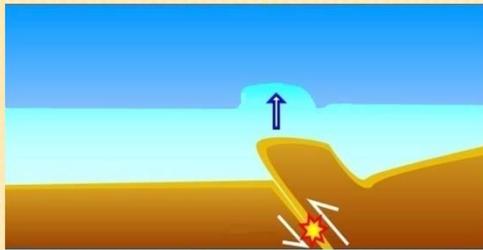


TSUNAMI



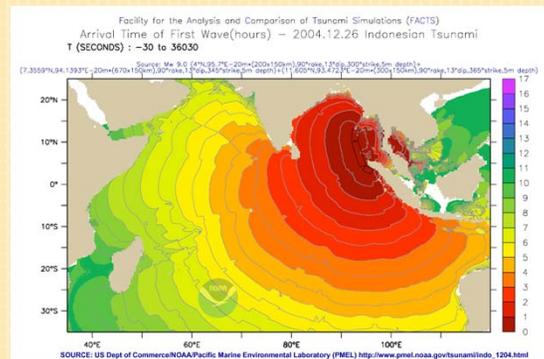
STAGES OF A TSUNAMI

Generation



How are tsunamis created?

Propagation



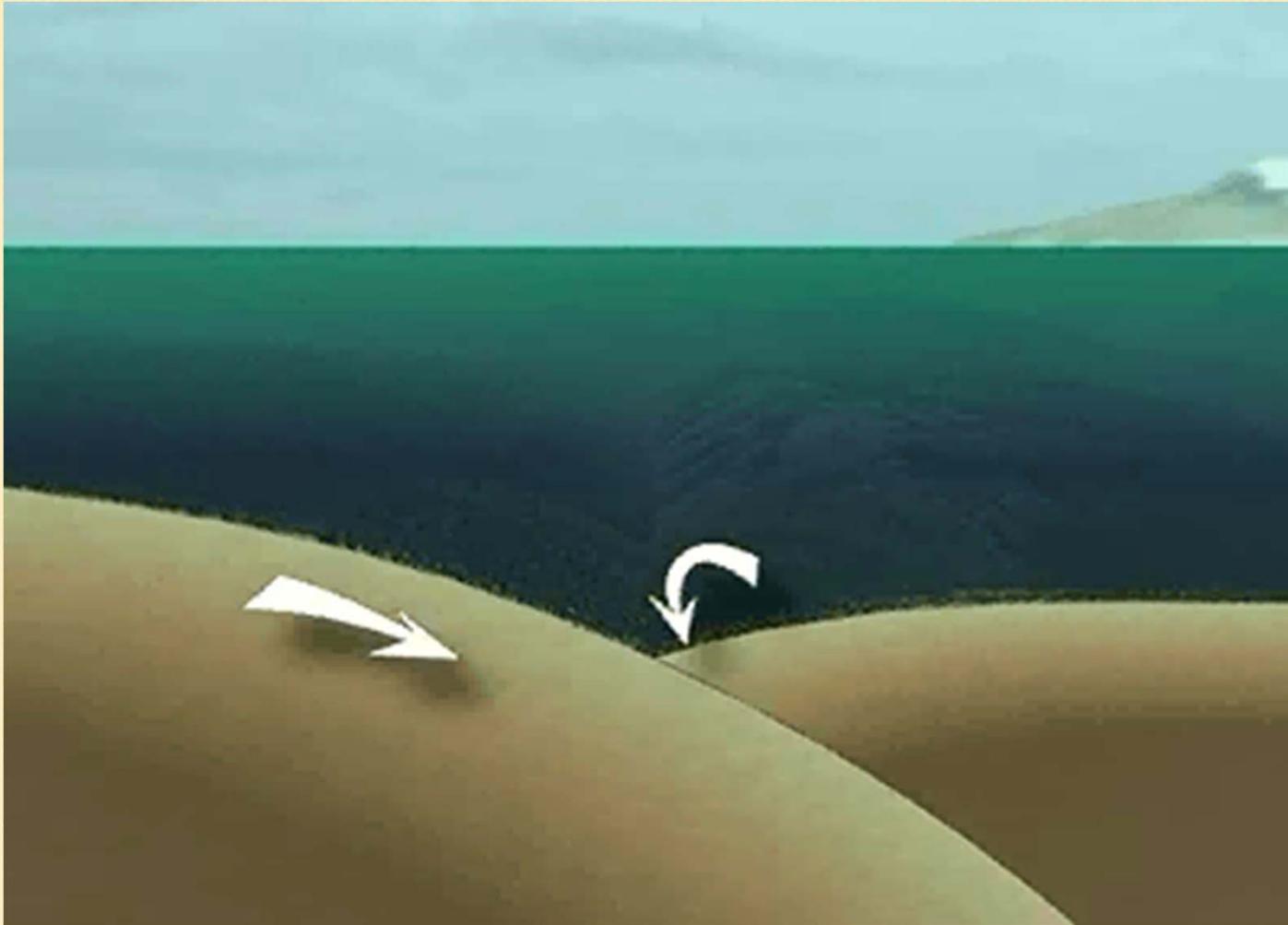
How do they move through the ocean?

Inundation



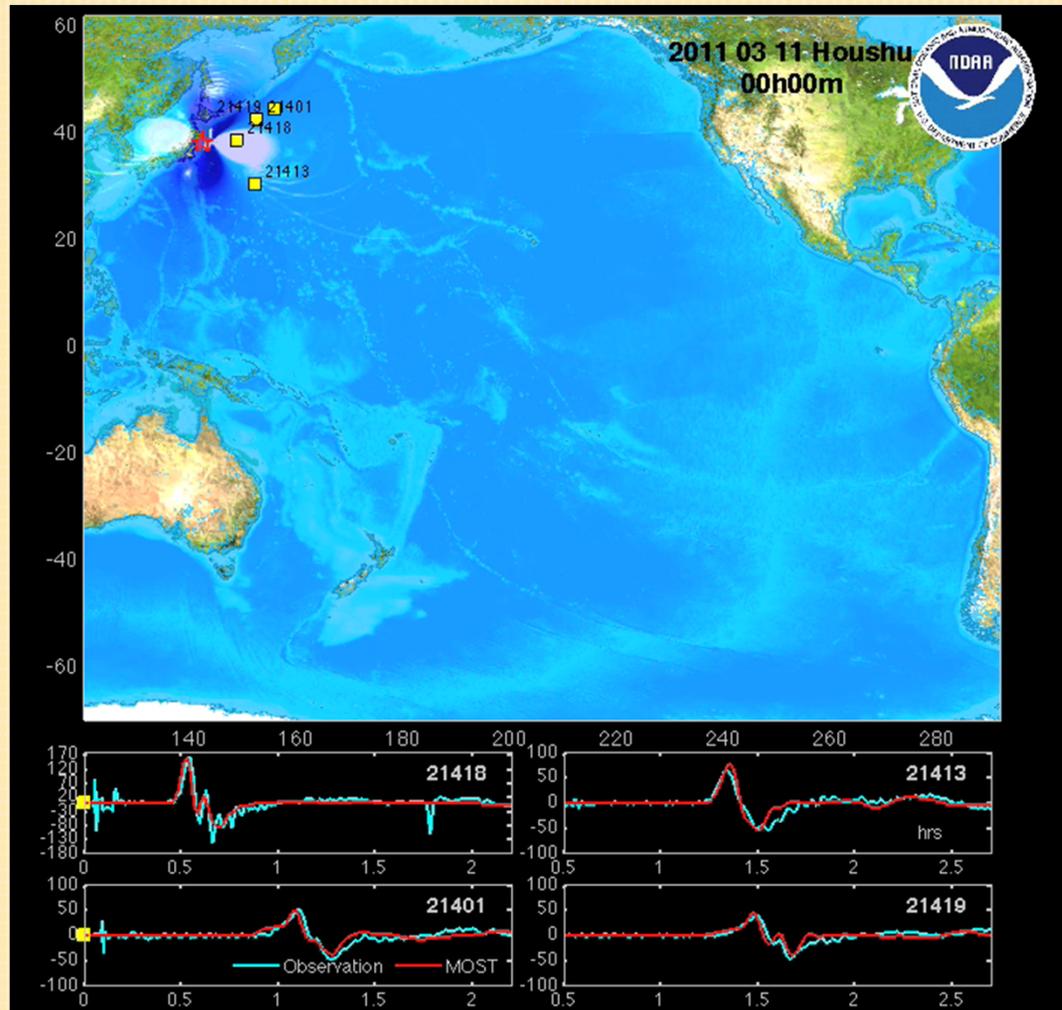
What happens when they hit land?

TSUNAMI GENESIS



Source: http://ffden-2.phys.uaf.edu/645fall2003_web.dir/elena_suleimani/generation_small.mov

TSUNAMI PROPAGATION



Source: <http://nctr.pmel.noaa.gov/honshu20110311/>

TSUNAMI INUNDATION



TSUNAMI DAMAGE



Yomiuri Shimbun, AFP/Getty Images

TSUNAMI DAMAGE



Motoya Nakamura / The Oregonian

HOW DO YOU KNOW A TSUNAMI IS HAPPENING?

× Natural Warnings

- + Earth shaking
- + Water recedes
- + Loud roar

× Official Warnings

- + NOAA/NWS alerts

WHAT YOU REALLY NEED TO KNOW ABOUT A TSUNAMI

× Three Things

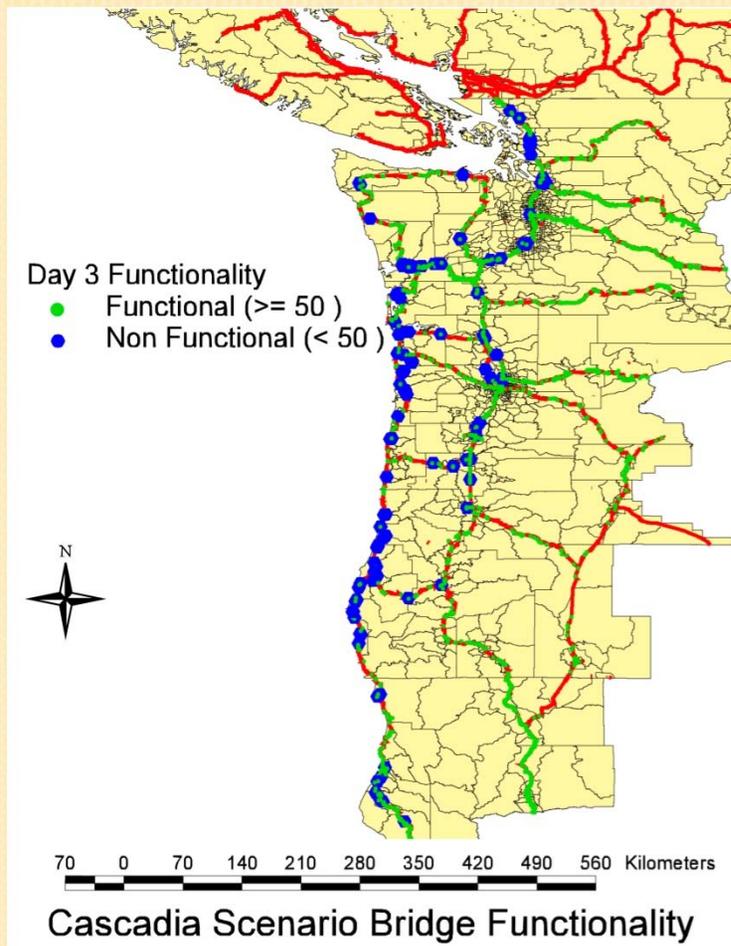
- + It is a series of waves
- + Stay away for 24 hours
- + Even small tsunamis can cause damage

BACK TO EARTHQUAKES

WHO IS IMPACTED BY A CSZ EQ?

- ✘ 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

WHAT ARE THE RISKS & IMPACTS?



- Infrastructure and lifelines will be seriously damaged
 - In Oregon, 399 bridges would have totally or partially collapsed under an M 9.0 Cascadia Subduction Zone earthquake, and 621 bridges would have been heavily damaged.
 - Most state routes connecting Interstate I-5 with the Oregon Coast Highway would be closed. The estimated time of closure could be 3 to 12 months.
 - The restoration of the entire transportation network could take 3 to 5 years, and would require a nationwide effort.

WHAT ARE THE RISKS & IMPACTS?



Schools and emergency facilities collapse

- Excluding hospitals, the estimated replacement value of this building stock totals approximately \$11.5 billion, led by the K-12 schools at 85%, community colleges 8%, fire 5%, and police 2%. (2007)



WHAT ARE THE RISKS & IMPACTS?



- Hundreds of thousands of people will need food, water, and shelter to be supplied for the foreseeable future.

WHAT ARE THE DANGERS FROM AN EQ?

- ✘ Strong ground shaking
- ✘ Surface fault rupture
- ✘ Liquefaction
- ✘ Landslides
- ✘ Tsunami
- ✘ Coastal subsidence

WHAT ARE THE HAZARDS?

✘ Surface fault rupture



2010 Canterbury, New Zealand



2009 Wenchuan, China

WHAT ARE THE HAZARDS?

- ✘ Strong ground shaking



2010 Haiti earthquake



2011 Tohoku earthquake

WHAT ARE THE HAZARDS?

✘ Coastal subsidence



2004 Sumatra



Mainichi Shimbun, Reuters

WHAT ARE THE HAZARDS?

✘ Landslides



Landslides in Ferndale, WA



2010 Taiwan

WHAT ARE THE HAZARDS?

✘ Liquefaction

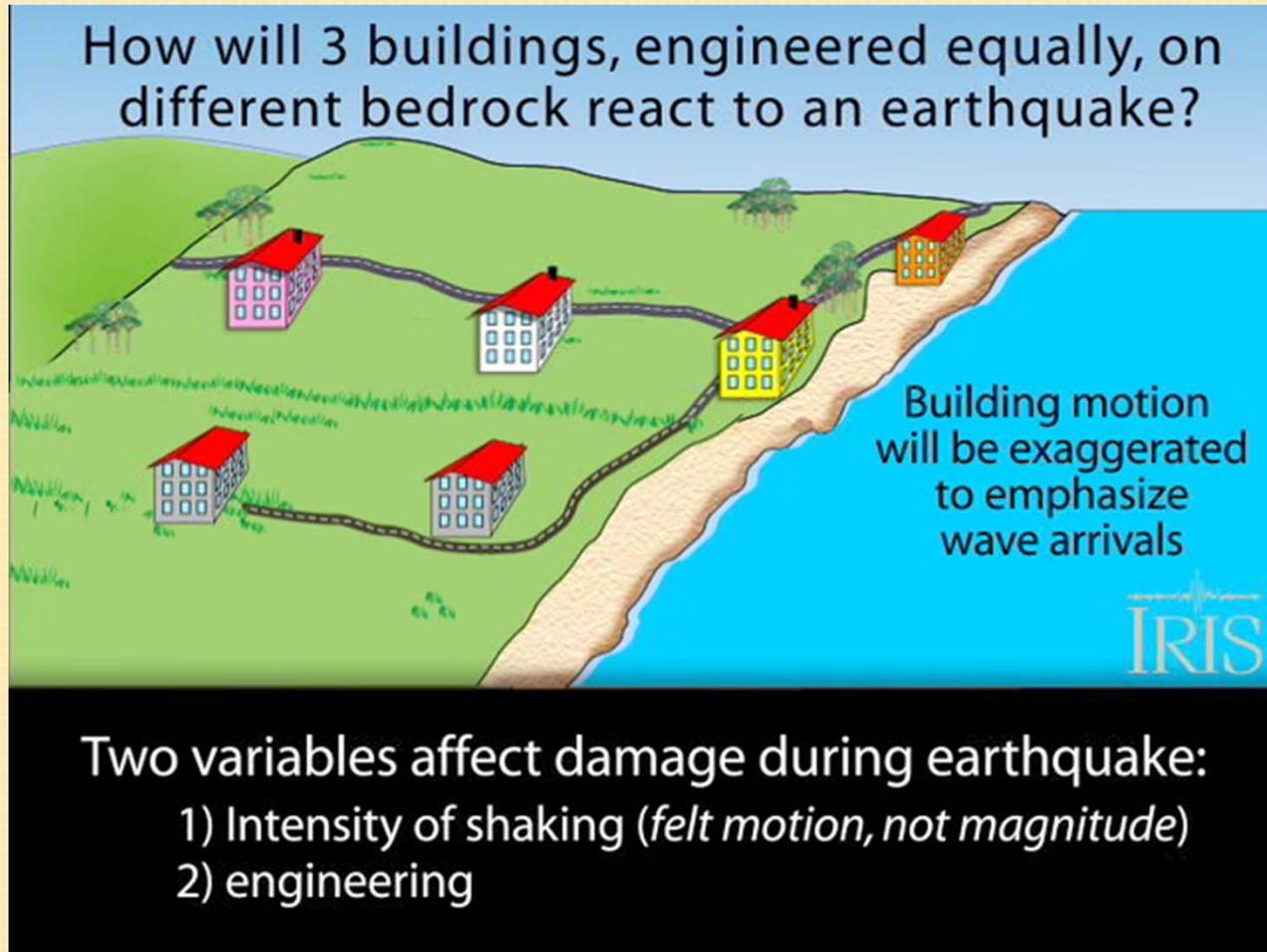


1964 Alaska



2011 Christchurch, New Zealand

WHAT IS LIQUEFACTION?



WHAT ARE THE HAZARDS?

✘ Tsunami



2004 Indonesian tsunami



2011 Tohoku tsunami

DANGERS ASSOCIATED WITH EARTHQUAKES

- Partial building collapse, such as collapsing walls, falling ceiling plaster, dislodged light fixtures and pictures.
- Flying glass from shattered windows.
- Overturnd furniture such as cabinets, floor lamps or book cases.
- Fires, broken gas lines and similar causes.
- Fallen power lines.
- Inappropriate actions resulting from panic.

GREAT OREGON SHAKEOUT

Join Us
for the Largest
Earthquake Drill
in Oregon
History.

October 18, 2012

shakeout.org/oregon

The Great
Oregon
**Shake
Out**TM

YOU CAN'T PREVENT AN EARTHQUAKE, BUT YOU CAN PREPARE FOR ONE

- Questions?
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