



Washington Earthquake Hazards: What to Expect When You're Expecting an Earthquake



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Washington is “Earthquake and Tsunami Country”

Washington has the **2nd highest earthquake risk and one of the highest tsunami risks in the US**

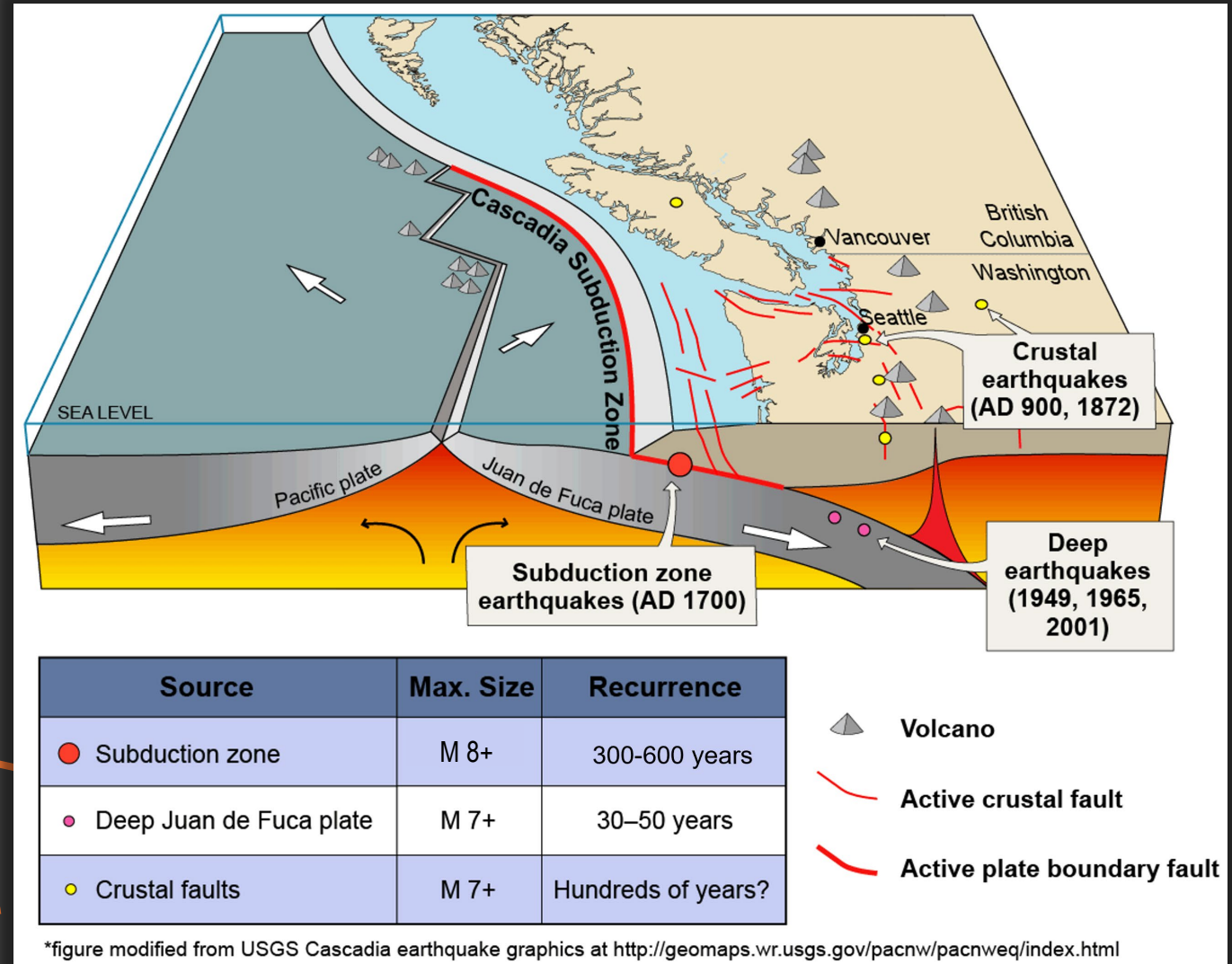
There are 3 different types of earthquakes possible in Washington.

1. Subduction Zone
2. Deep Earthquakes
3. Crustal Faults

“The Big One”

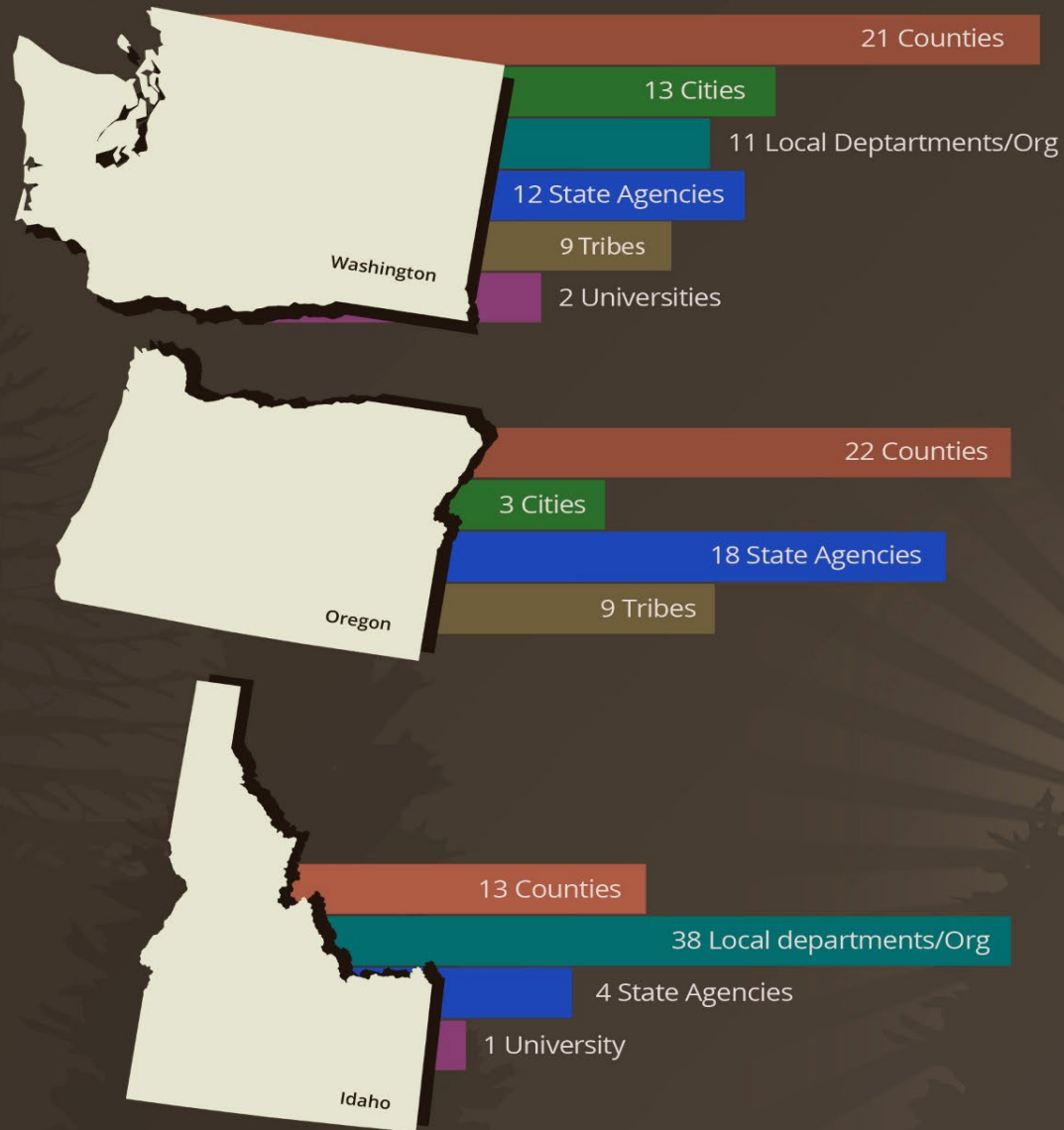
Nisqually, 2001

Seattle & Tacoma Faults



Cascadia Rising 2016: Emergency Management Teamwork

Testing catastrophic response plans at all levels - As of March 4, 2016



MACRO-PARTICIPATION

- 70 Emergency Operation Centers
- ~250 Exercise Planners
- ~3500 Exercise Players
- ~500 Exercise Controller/Evaluators



Over 23,000 Participants

M9.0 CSZ Tsunami Casualty and Building Loss Estimates for WA

Updated total population (permanent and non-permanent):
175,555-300,000+ people (depending on time of year)

Updated casualties:

10-minute departure time: **50,433** casualties

15-minute departure time: **57,313** casualties

20-minute departure time: **65,386** casualties

That's **29%-37%** of the total population

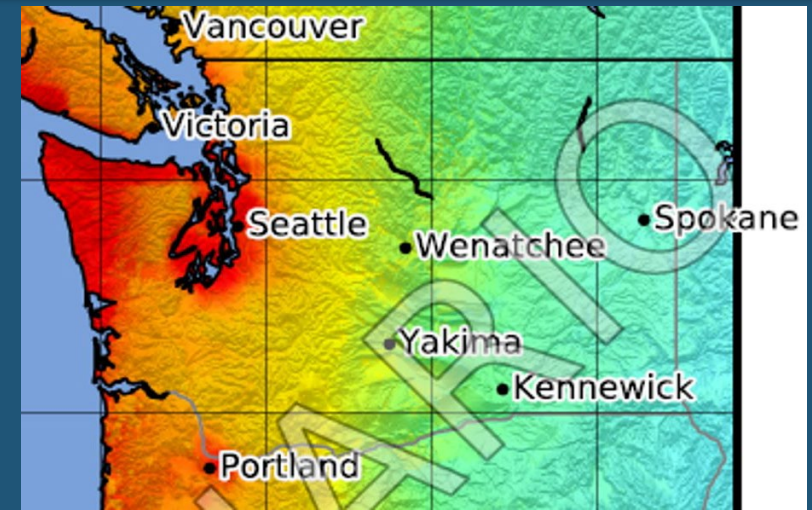
Updated total # of buildings :

39,381 buildings

Building and Content Repair Cost estimates:

Median Shaking: **\$18 billion**

84th Percentile Shaking: **\$22 billion**

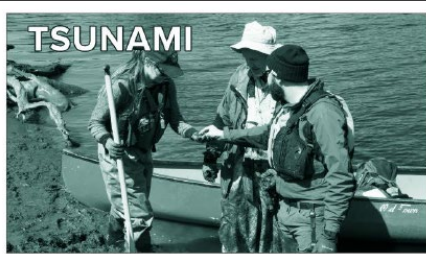
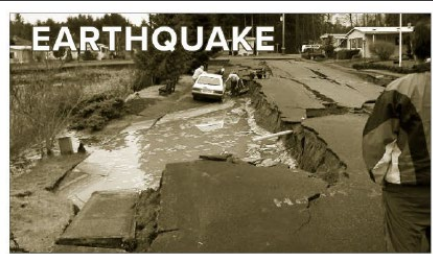


Cascadia Subduction Zone M 9.0 Ensemble ShakeMaps

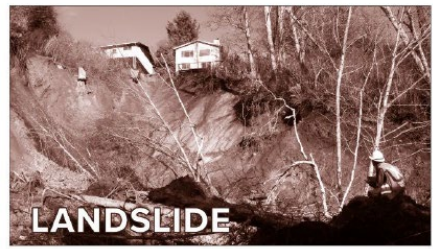


Extended L1 M_w 9.0 Cascadia Subduction Zone Megathrust Earthquake Scenario

Washington Geological Survey Clearinghouse



Washington Geologic Hazards Clearinghouse Plan



- ALL Hazards
- Collaborative with multiple agencies
- Physical location & meetings
- Data collection & archiving infrastructure
- Any scientist can participate
- Possible activation for any magnitude (M) 5.5 or greater earthquakes in Washington

We use scenarios to plan and practice our Clearinghouse

Survey123 forms allow collaboration without accounts or digital mapping expertise



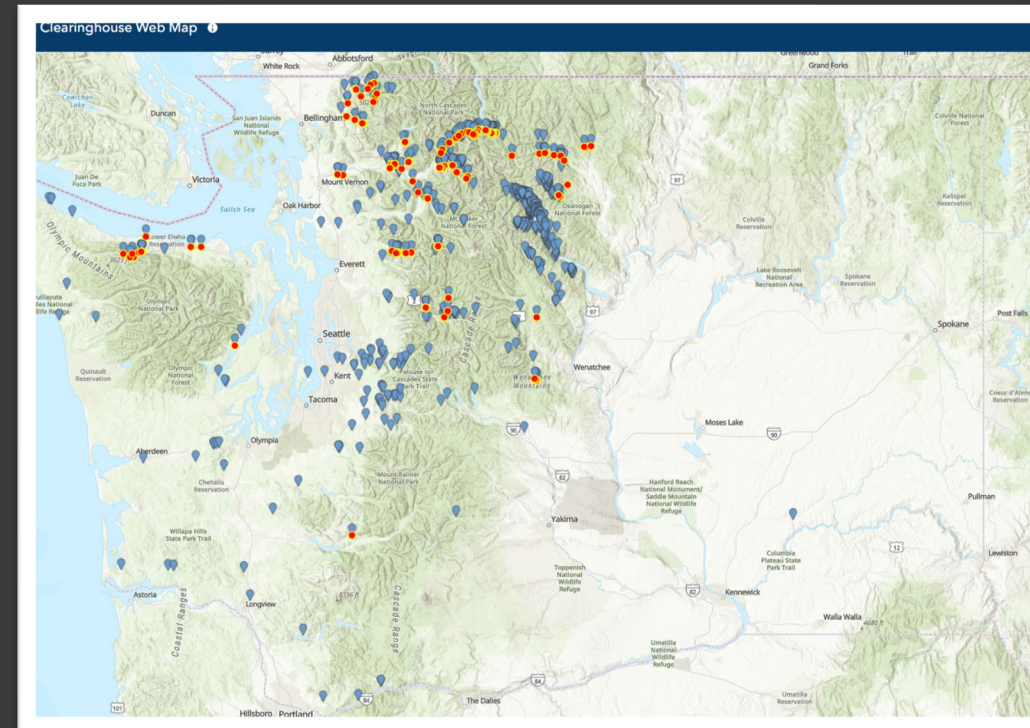
2025 Atmospheric River Landslides Clearinghouse



- 670 landslides (and counting!)
- Landslide ID methods: News, social media, partner reports/data, the public
- 154 field clearinghouse forms filled out
- Drone flights
- 2 aerial reconnaissance flights
- Sentinel 2 imagery



Washington Geologic Hazards Clearinghouse Plan

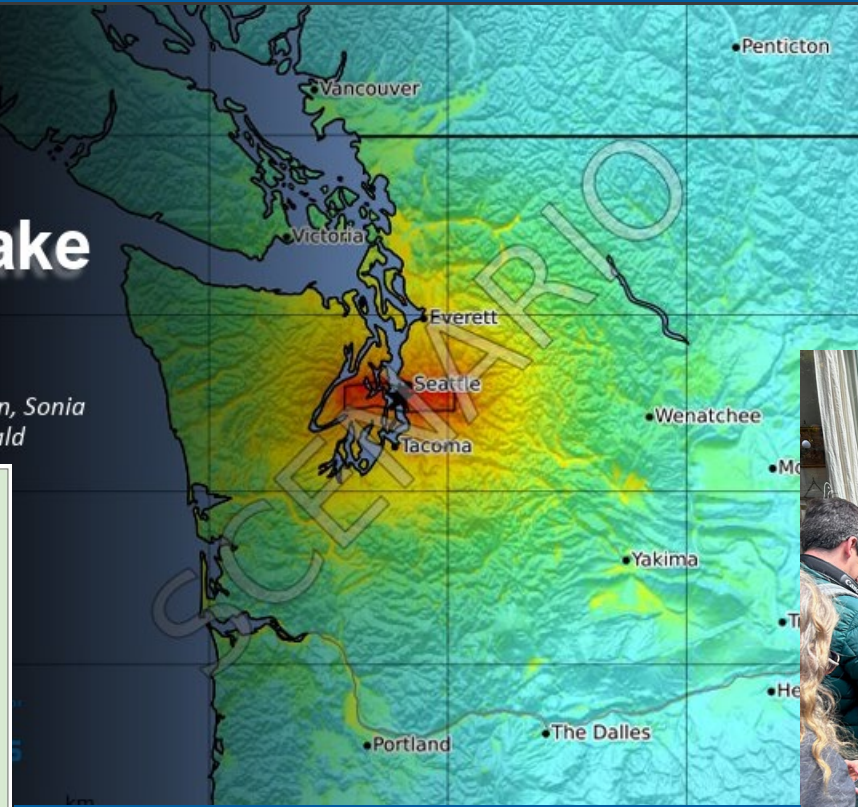


Exercise with EERI at 2024 Annual Meeting



Seattle fault M_w 7.5 Earthquake Scenario

Stephen Angster, Megan Anderson, Corina Allen, Sonia Ellison, Eric Thompson, Brian Sherrrod, Dave Wald

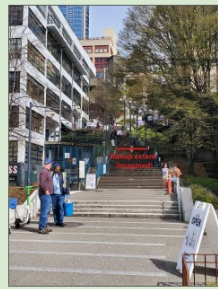


- U.S. Geological Survey
- EERI Engineering Community
- WA Emergency Management Division
- Seattle Emergency Management

Survey123 Stop B: Pike Street Hill Climb
Tsunami Inundation Limit



View looking west down the stairs



View looking east up the stairs



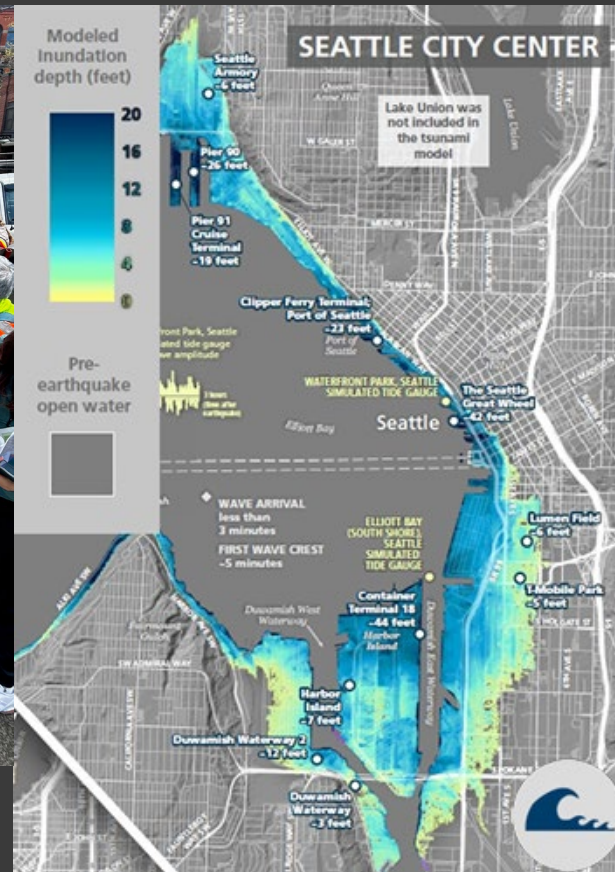
Photo from the Tohoku Tsunami, Japan 2011- imagine this is what you see on and along the stairs.

The tsunami inundation limit is well marked by debris on the stairs of the Pike Street Hill Climb. The debris ends just short of the top of the stairway and deck over the blue gate marked "Hoffman Office". You also see a high water mark on the surrounding buildings at the same height as the highest debris.



Actual photo of high water mark from 2001 tsunami in La Punta, Peru. This is what you can describe for the high water mark on the surrounding buildings.

1. There is a procedure
2. Each agency knows how the others are responding
3. Build community
4. Think through scenarios together



Crustal fault scenario event ShakeMaps 2024



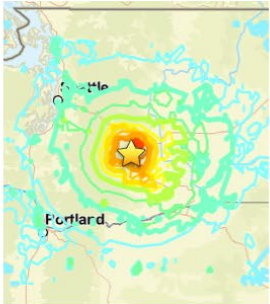
M 7.1 Scenario Earthquake – Manastash Fault

2024-02-19 18:00:00 (UTC) | 46.794°N 120.664°W | 7.5 km depth

! This event is a scenario (it did not occur) and should only be used for planning purposes.

[More information about scenarios](#)

Interactive Map



Contributed by US

Regional Information



Contributed by US

Felt Report - Tell Us!

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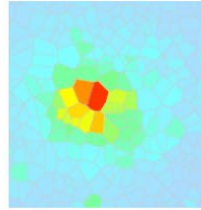
Responses

Contribute to citizen science. Please [tell us](#) about your experience.

Citizen Scientist Contributions

ShakeMap

IX

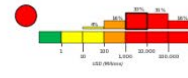


Estimated Intensity Map

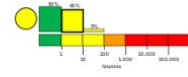
Contributed by US

PAGER

RED



Estimated Economic Losses



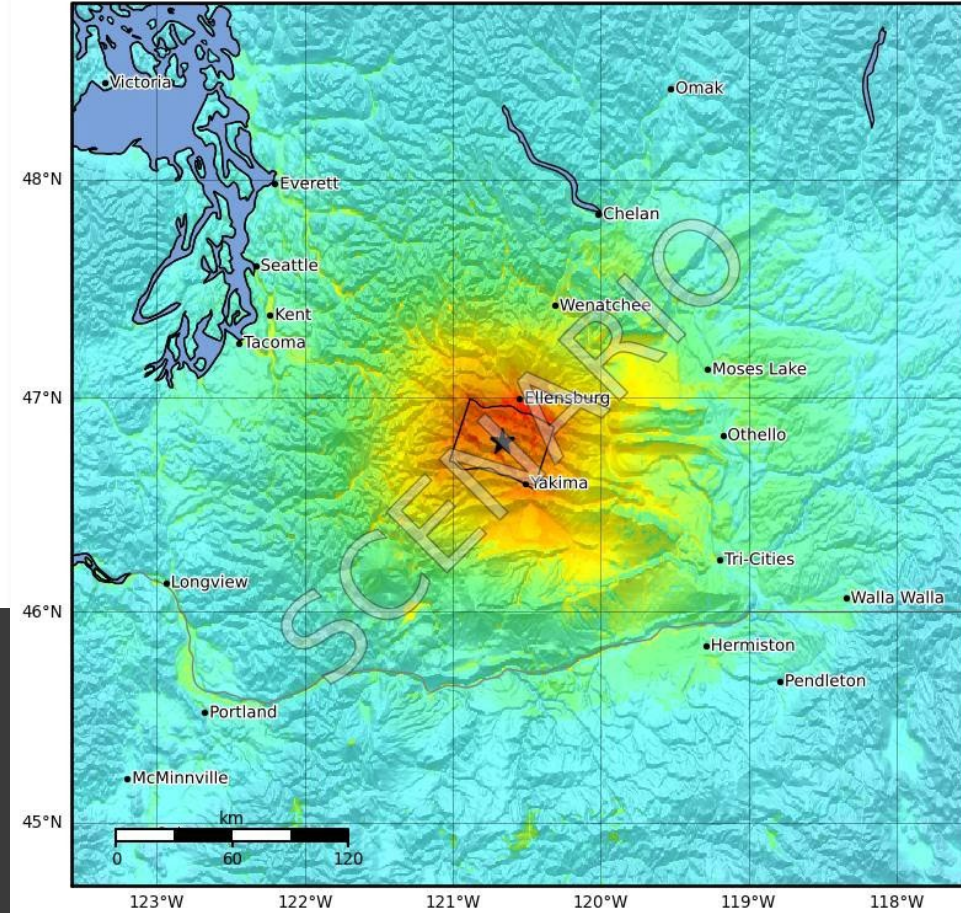
Estimated Fatalities

Contributed by US

Macroseismic Intensity Map USGS

ShakeMap: Manastash Fault

Feb 19, 2024 18:00:00 UTC M7.1 N46.79 W120.66 Depth: 7.5km ID:mf01_se



SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	None	None	None	Very light	Light	Moderate	Moderate/heavy	Heavy	Very heavy
PGA(%g)	<0.0464	0.297	2.76	6.2	11.5	21.5	40.1	74.7	>139
PGV(cm/s)	<0.0215	0.135	1.41	4.65	9.64	20	41.4	85.8	>178
INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based on Worden et al. (2012)

Version 1: Processed 2024-03-29T23:22:41Z

△ Seismic Instrument ○ Reported Intensity

★ Epicenter □ Rupture

- Collaboration with USGS
- 24 Fault segments
- We continue to revise our active faults catalog with emerging research

What follow-on products would be useful for the broader community?