

# PNW Seismicity Catalogs and Waveform Data

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# Focus (by request)

Available seismicity catalogs, waveform data, and associated considerations for contributing to future ground-motion model databases or validation events.

What is available since the NGA-Subduction database was developed over 5 years ago now?

There is a lot more data, including full waveforms that can be used for validation of simulations

# Earthquake Catalogs

For the Pacific Northwest

- Official Catalogs, including historical events → complete for events large enough to produce felt shaking

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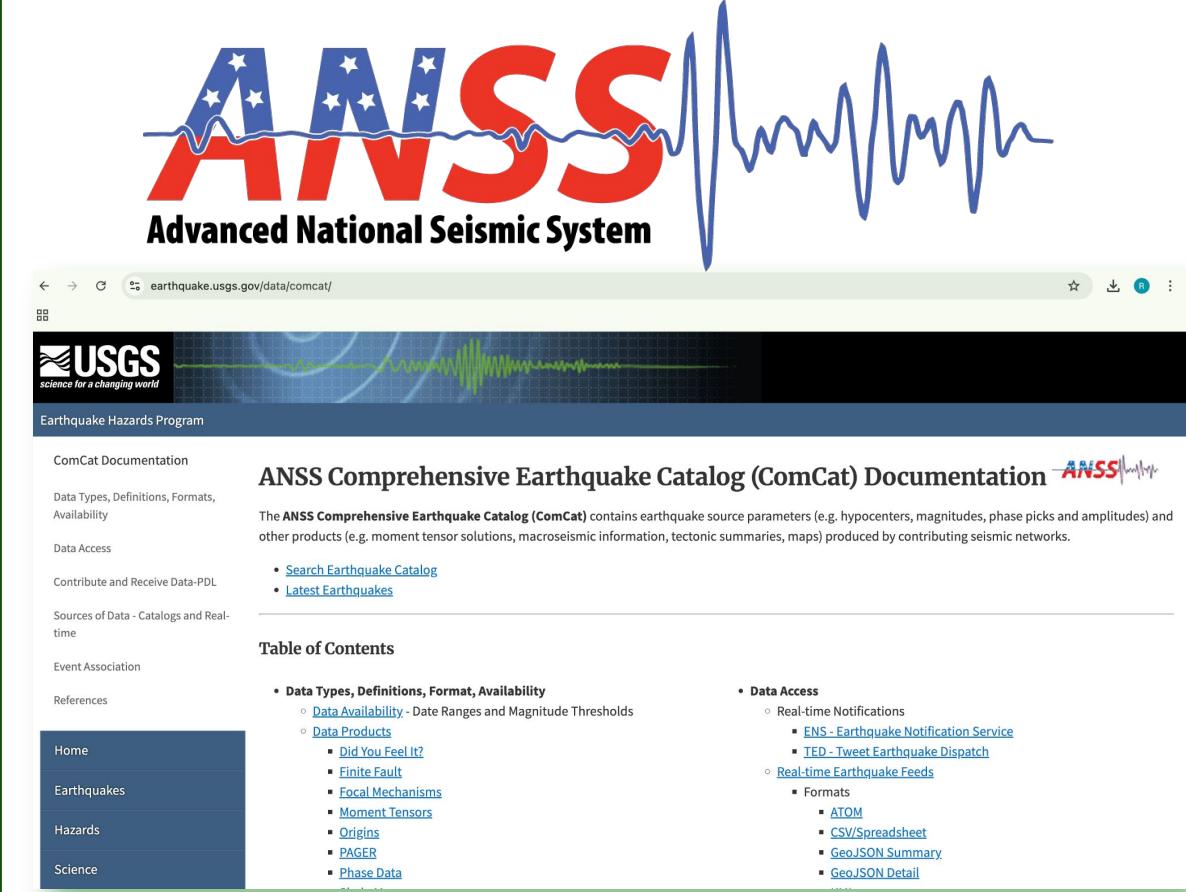
# Earthquake Catalogs

For the Pacific Northwest

- Official Catalogs, including historical events → complete for events large enough to produce felt shaking
- Strong-motion Catalogs → processed for engineers
- Research Catalogs → may include smaller magnitudes or **more accurate event parameters**

# ANSS ComCat

- Official catalog for the USA, also has global events
- In the USA: several “authoritative” contributors → ANSS ComCat will serve the “preferred” solutions

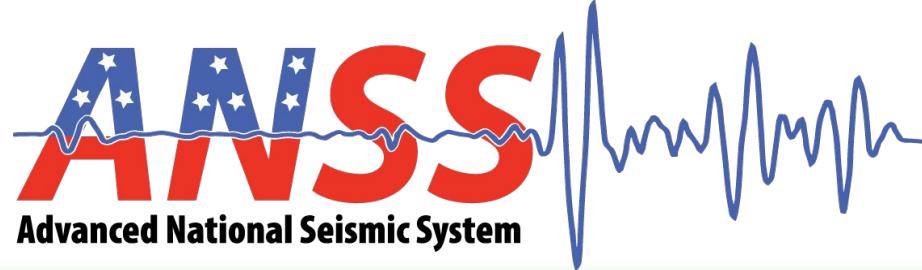


The image shows the Advanced National Seismic System (ANSS) logo at the top, featuring the word "ANSS" in large red letters with blue stars above it, and a blue seismic wave graphic. Below the logo is the text "Advanced National Seismic System". Below this is a screenshot of a web browser displaying the URL "earthquake.usgs.gov/data/comcat/". The page header includes the USGS logo and "Earthquake Hazards Program". The main content area is titled "ANSS Comprehensive Earthquake Catalog (ComCat) Documentation" with the ANSS logo. It contains a brief description of the catalog, links to "Search Earthquake Catalog" and "Latest Earthquakes", and a "Table of Contents" section. The "Table of Contents" lists several categories: Data Types, Definitions, Format, Availability; Data Products (Did You Feel It?, Finite Fault, Focal Mechanisms, Moment Tensors, Origins, PAGER, Phase Data); Data Access (Real-time Notifications, ENS - Earthquake Notification Service, TED - Tweet Earthquake Dispatch); and Real-time Earthquake Feeds (Formats, ATOM, CSV/Spreadsheet, GeoJSON Summary, GeoJSON Detail).

earthquake.usgs.gov

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- For official Canadian event information, see NRCan



The image shows the ANSS (Advanced National Seismic System) logo, which consists of the letters 'ANSS' in large red and blue block letters. The 'A' and 'N' are blue, while the 'S' and 'S' are red. Above the letters are several white stars of varying sizes. Below the letters is a blue seismogram line with vertical spikes, representing seismic waves. To the right of the logo is a smaller, stylized blue seismogram line with vertical spikes.

[earthquake.usgs.gov/data/comcat/](http://earthquake.usgs.gov/data/comcat/)

Earthquake Hazards Program

ComCat Documentation

Data Types, Definitions, Formats, Availability

Data Access

Contribute and Receive Data-PDL

Sources of Data - Catalogs and Real-time

Event Association

References

Home

Earthquakes

Hazards

Science

ANSS Comprehensive Earthquake Catalog (ComCat) Documentation 

The ANSS Comprehensive Earthquake Catalog (ComCat) contains earthquake source parameters (e.g. hypocenters, magnitudes, phase picks and amplitudes) and other products (e.g. moment tensor solutions, macroseismic information, tectonic summaries, maps) produced by contributing seismic networks.

- [Search Earthquake Catalog](#)
- [Latest Earthquakes](#)

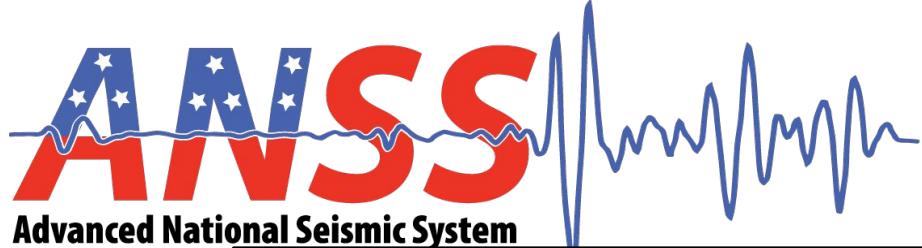
Table of Contents

- **Data Types, Definitions, Format, Availability**
  - [Data Availability](#) - Date Ranges and Magnitude Thresholds
  - [Data Products](#)
    - [Did You Feel It?](#)
    - [Finite Fault](#)
    - [Focal Mechanisms](#)
    - [Moment Tensors](#)
    - [Origins](#)
    - [PAGER](#)
    - [Phase Data](#)
- **Data Access**
  - Real-time Notifications
    - [EWS - Earthquake Notification Service](#)
    - [TED - Tweet Earthquake Dispatch](#)
  - [Real-time Earthquake Feeds](#)
    - Formats
      - [ATOM](#)
      - [CSV/Spreadsheet](#)
      - [GeoJSON Summary](#)
      - [GeoJSON Detail](#)

earthquake.usgs.gov

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ANSS  
Advanced National Seismic System

earthquake.usgs.gov/data/comcat/

USGS science for a changing world

Earthquake Hazards Program

ComCat Documentation

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- Sources of Data - Catalogs and Real-time
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- References

ANSS ComCat

The ANSS ComCat is a component of the ANSS, which also includes other products (e.g.,

- Search Earthquakes
- Latest Earthquakes

Table of Contents

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earthquake.usgs.gov

# Natural Resources Canada <https://www.earthquakescanada.nrcan.gc.ca/>



Government  
of Canada

Gouvernement  
du Canada

Search Canada.ca



MENU ▾

[Canada.ca](#) > [Natural Resources Canada](#) > [Earthquakes Canada](#)

Earthquakes Canada

Recent  
Earthquakes

Historic Events

Earthquake Hazard

Be Prepared!

Station and Data

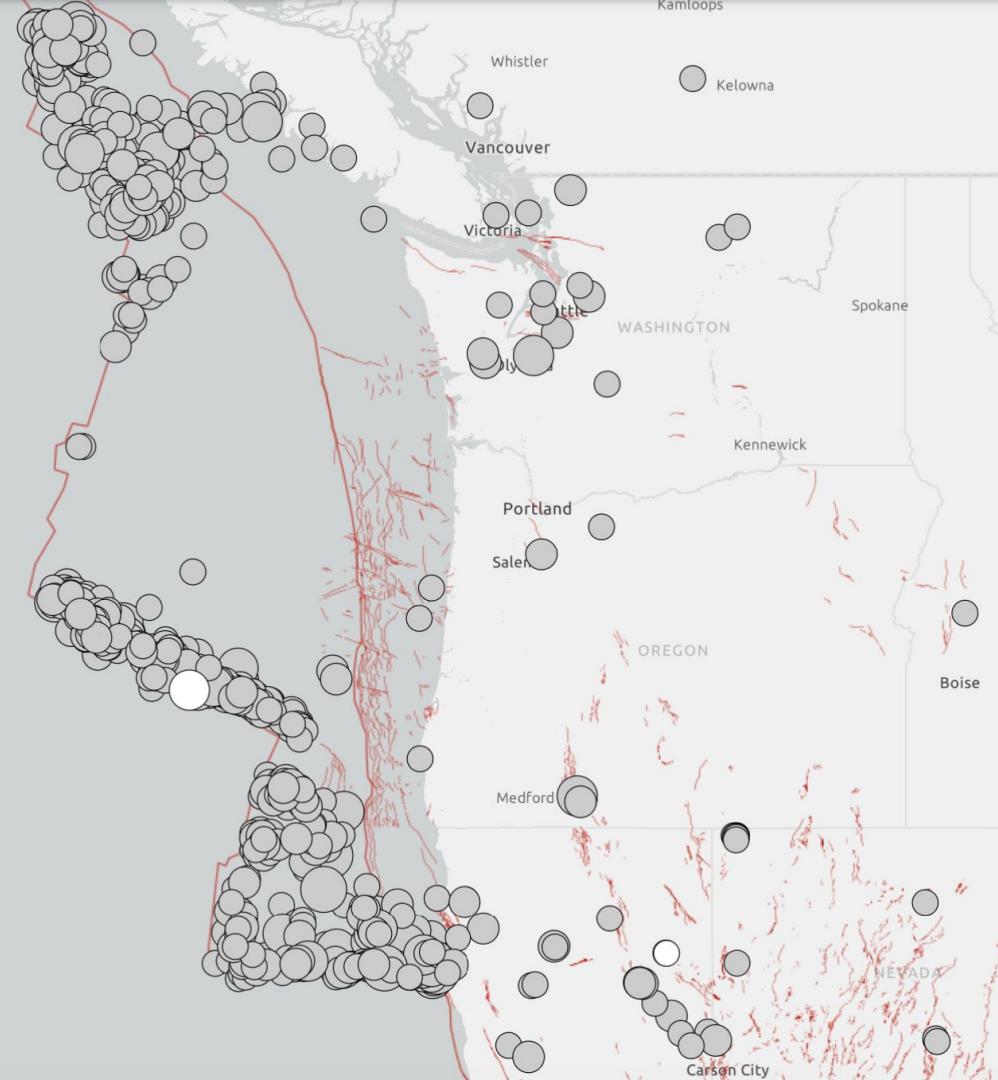
## Overview of the National Earthquake Database

The National Earthquake DataBase (NEDB) comprises a number of separate databases that together act as the national repository for all raw seismograph data, measurements, and derived parameters arising from the Canadian National Seismograph Network (CNSN), the Yellowknife Seismological Array (YKA), previous regional telemetered networks in

# ANSS ComCat

## M4.5+ since 1990

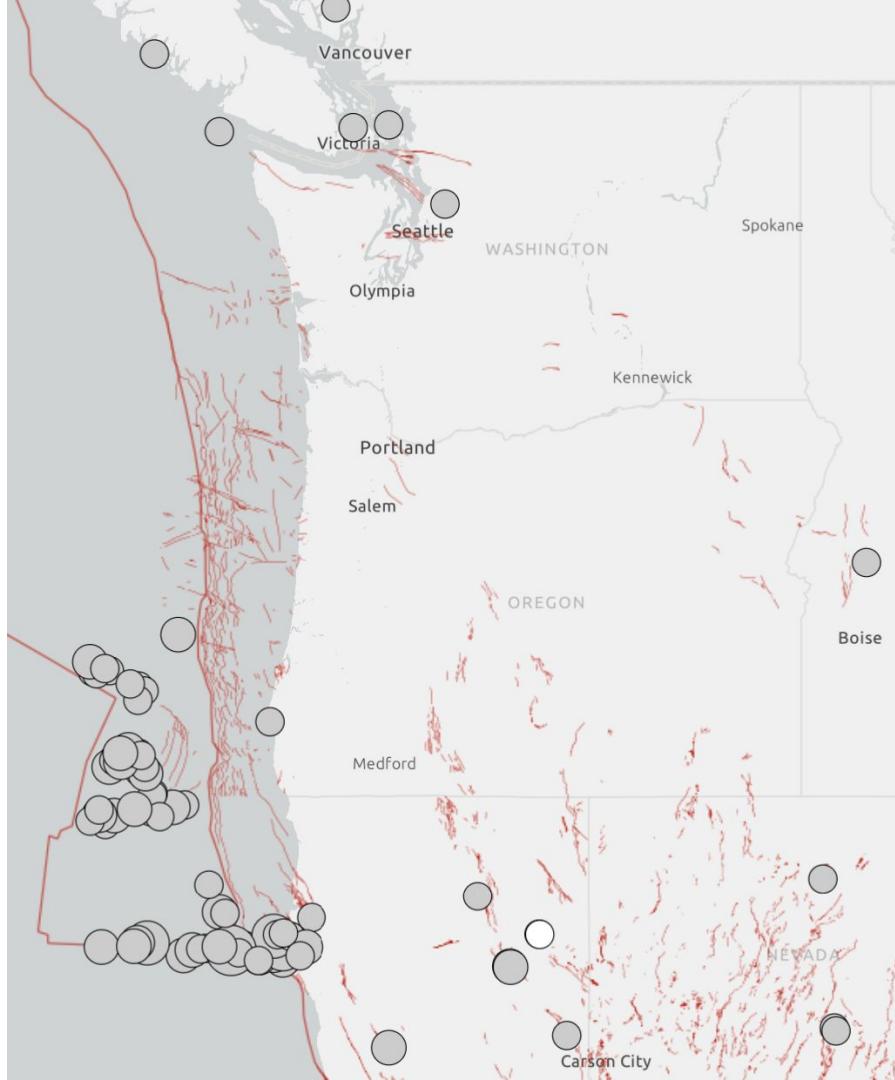
- *Many* within Gorda and Explorer plates
- *Many* associated with the ridges and fracture zones
- *Few* near and east of the Cascadia Deformation Front, except near Nootka FZ and Mendocino



# ANSS ComCat

## M4.5+ since 2015

- 6 M4.5+ events in the NW
- 37 off Oregon/Northern California, including 2 at/near the coast
- 39 in the Mendocino area

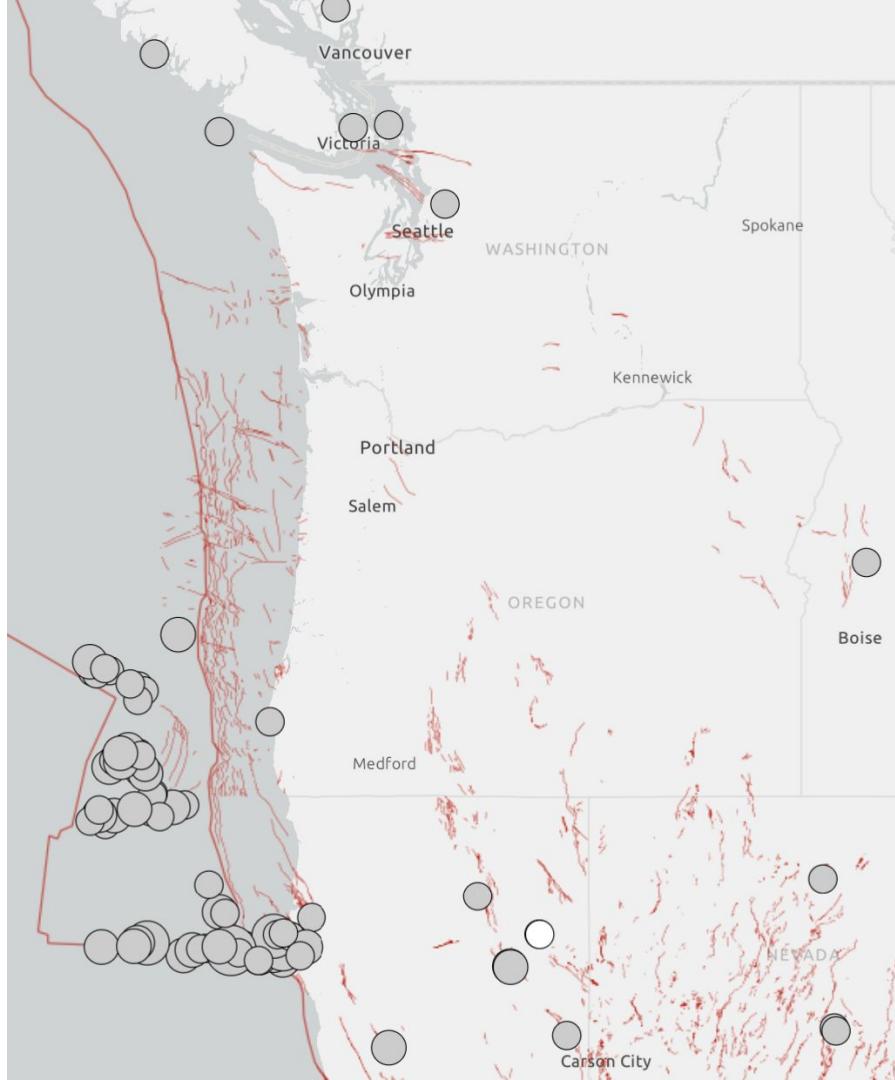


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**Get familiar with the search tools!**



# Event-associated strong-motion parameters

- Data used in ANSS ShakeMaps archived in ComCat or available from RSNs

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- NGA databases → combines ground motion measurements with more extensive event and site parameters

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- Data archived at the Center for Engineering Strong Motion Data (CESDC)
- NGA databases → combines ground motion measurements with more extensive event and site parameters
- Measure them yourself from full waveforms!

# Center for Earthquake Strong Motion Data

[strongmotioncenter.org](http://strongmotioncenter.org)

Center for Engineering Strong Motion Data

CESMD - A Cooperative Effort



About CESMD

Data for Latest Earthquakes  
Internet Quick Reports (IQR)

Archive

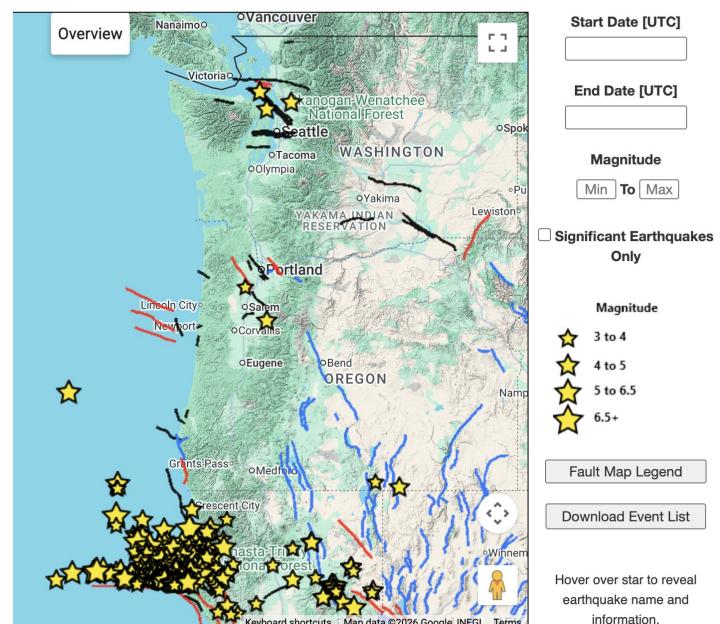
Search for Data  
from Specific Stations or Structure Types

[CISN](#) [AEIC](#) [PNSN](#) [IMW](#) [CEUS](#) [IRIS](#) [COSMOS](#)

Partner Data Centers and Networks

[Data Attribution and Use Policy](#)

## Earthquakes with Strong Motion Records in CESMD



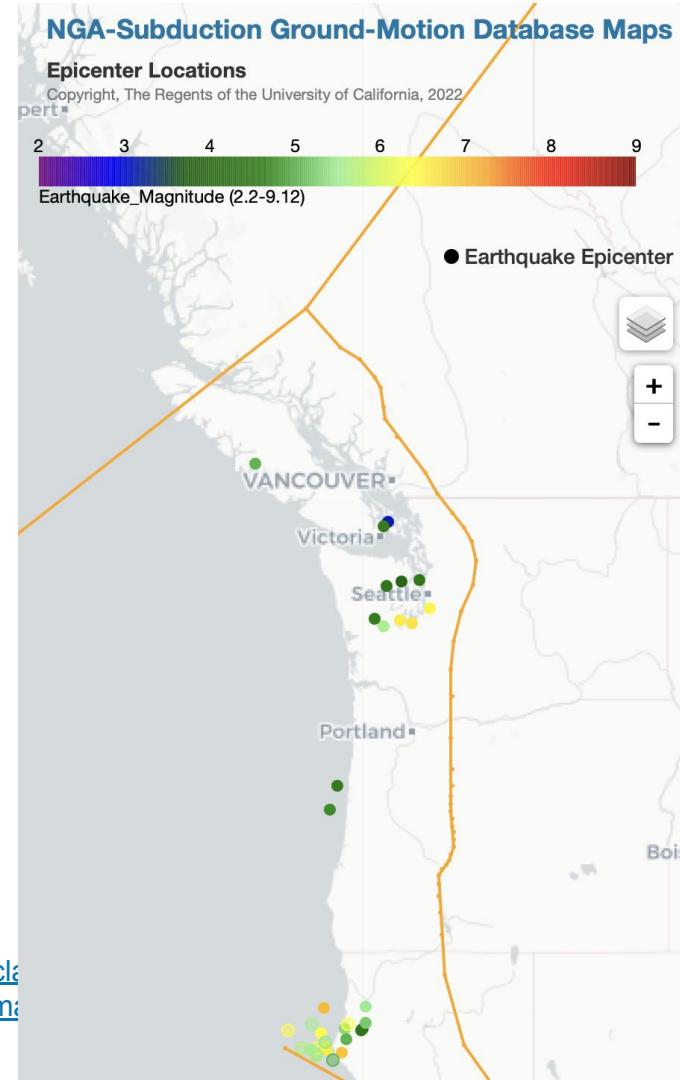
# NGA-subduction Cascadia

- 35 earthquakes
- M3.3-M6.8
- 1937 - 2015
- PGA, PGV, PGD
- SA 0.01s to 20s period

Many M4.5+ events and stations since 2015.

Before 2015: NGA event selection, strict criteria?

<https://www.risksciences.uc Berkeley.edu/nhr3/nga-subduction/maps>

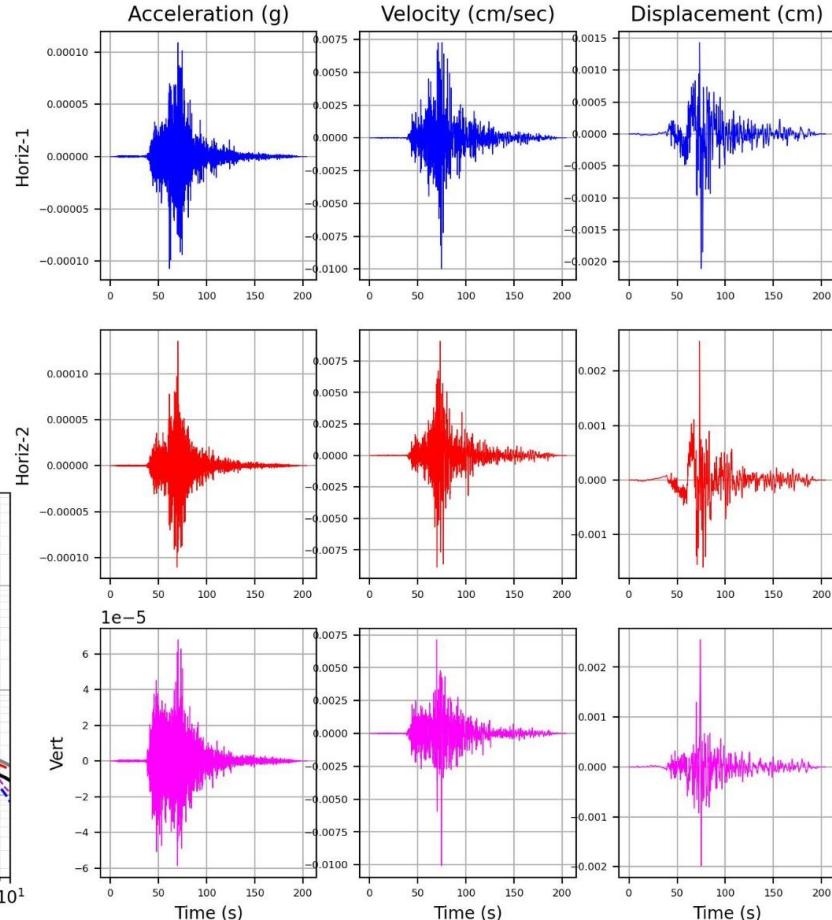
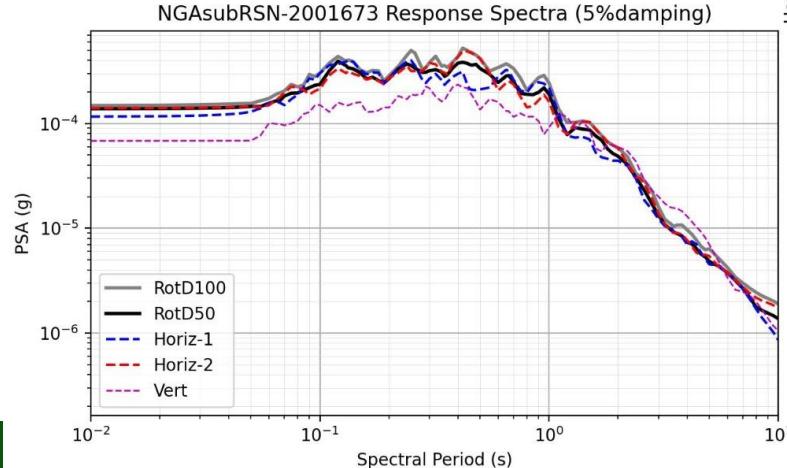


# Example of NGA-Subduction data processing

## NGA-SUBDUCTION GROUND-MOTION DATABASE

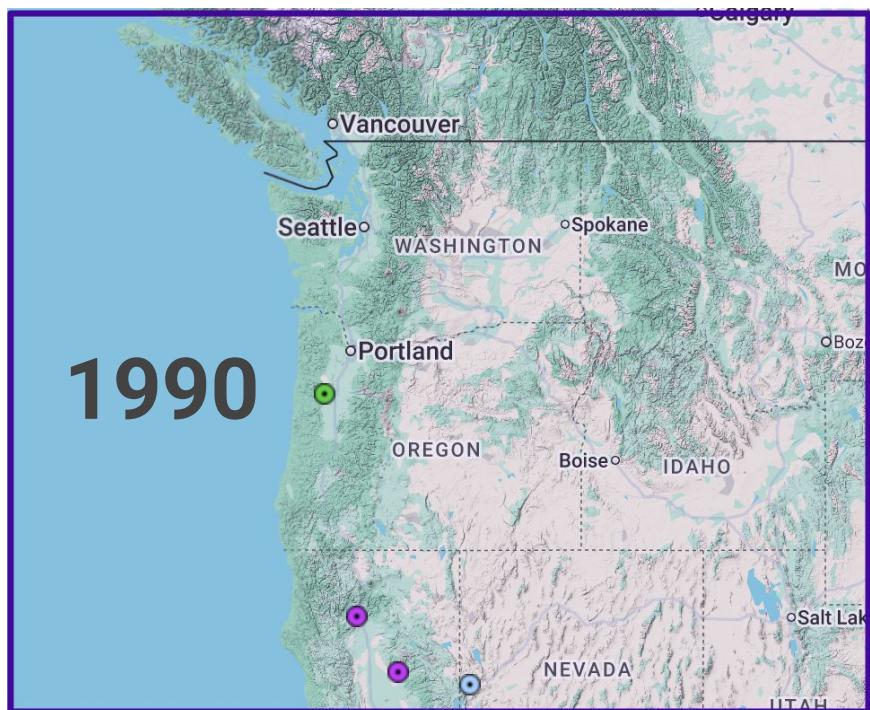
NGAsubRSN: 2001673  
DatabaseRegion: Cascadia  
NGAsubEQID: 2000007  
Earthquake\_Name: 930039  
EQYear: 2000  
Earthquake\_Magnitude: 5.2  
Hypocenter\_Depth\_km: 41.3  
Intra\_Inter\_Flag (0=Interface,1=Intraslab): 1  
NGAsubSSN: 200972  
StationDatabaseRegion: Cascadia  
Station\_Name: PGC  
Vs30\_Selected\_for\_Analysis\_m\_s: 455  
C1stD\_km: 217.839  
Lowest Useable Period (s): -999.0  
Highest Useable Period (s): 30.348  
Filename Horiz-1: NGAsubRSN2001673\_PGCBE  
Filename Horiz-2: NGAsubRSN2001673\_PGCBHN  
Filename Vert: NGAsubRSN2001673\_PGCBHZ

Natural Hazards Risk and Resiliency Research Center (NHR3)  
Copyright 2022 by The Regents of the University of California

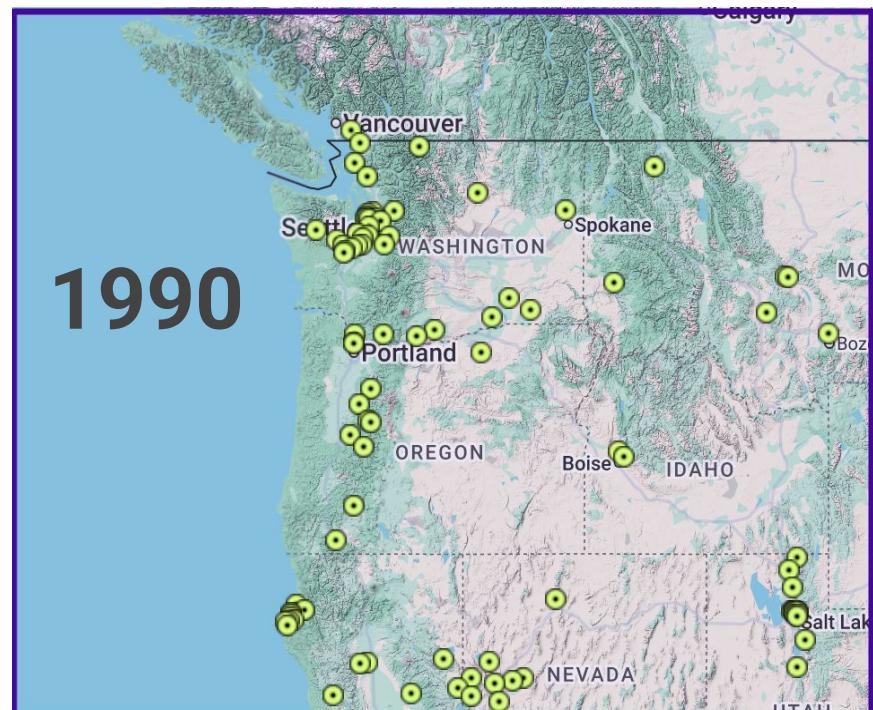


Seismic data density and quality  
has dramatically improved over  
time

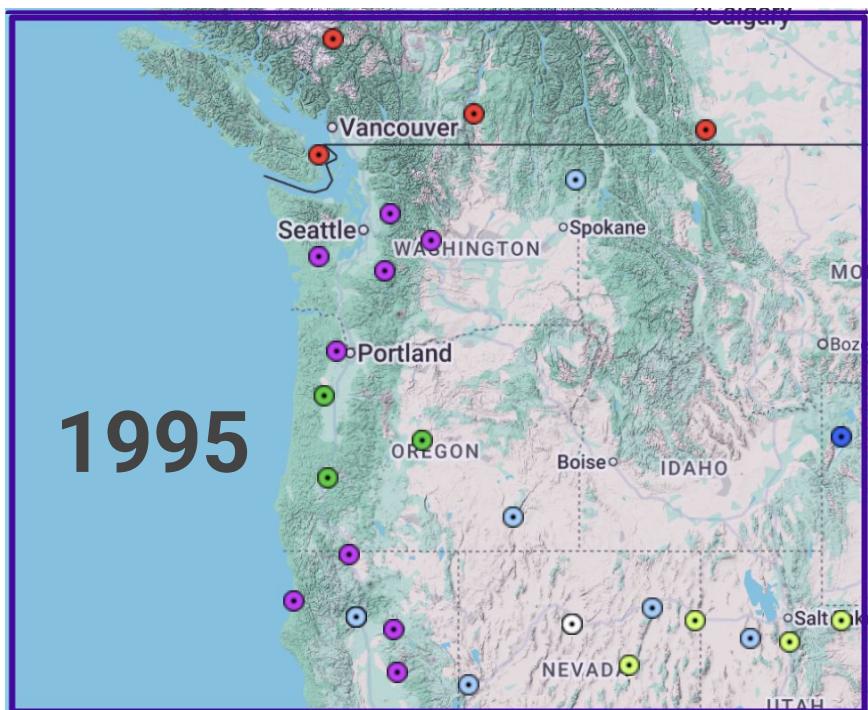
# Broadband sensors



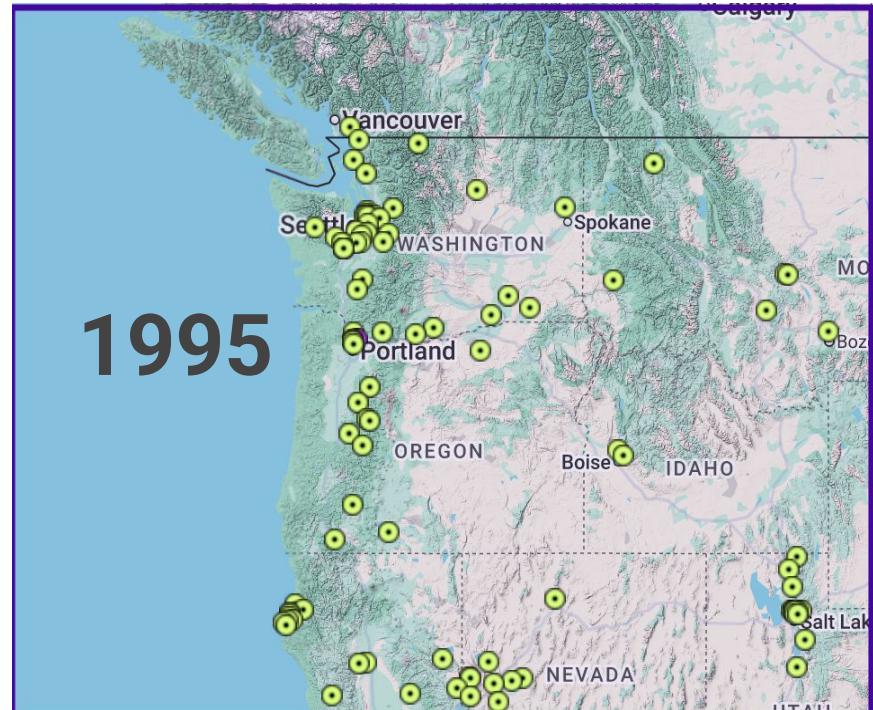
# Strong-motion sensors



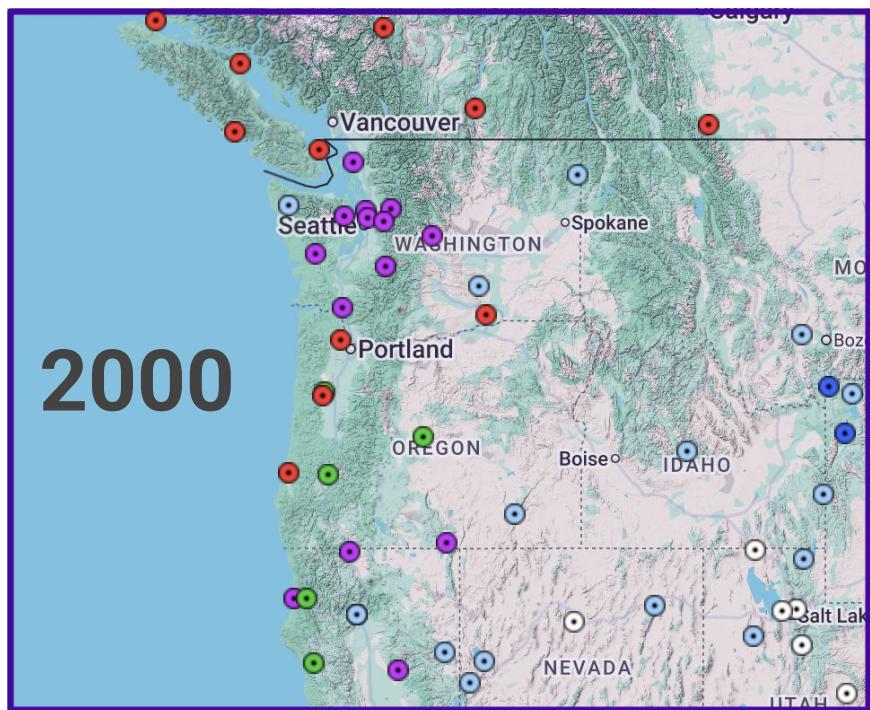
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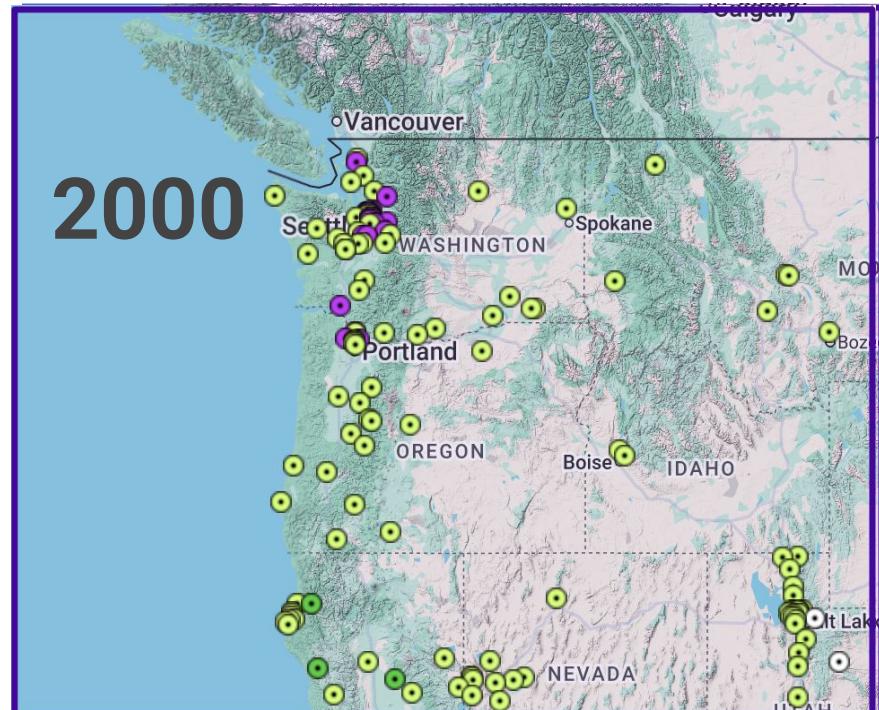
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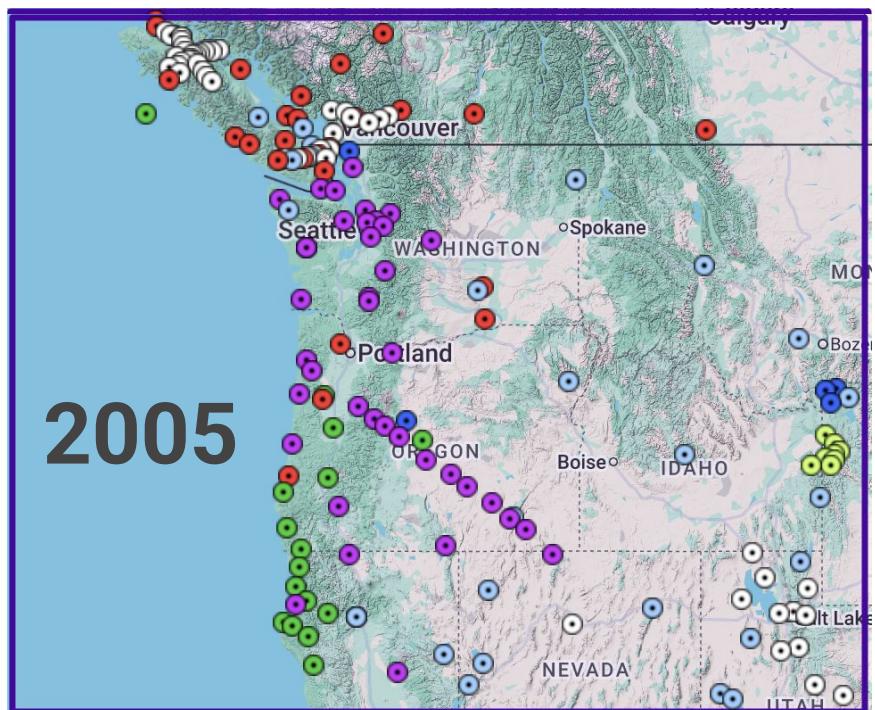
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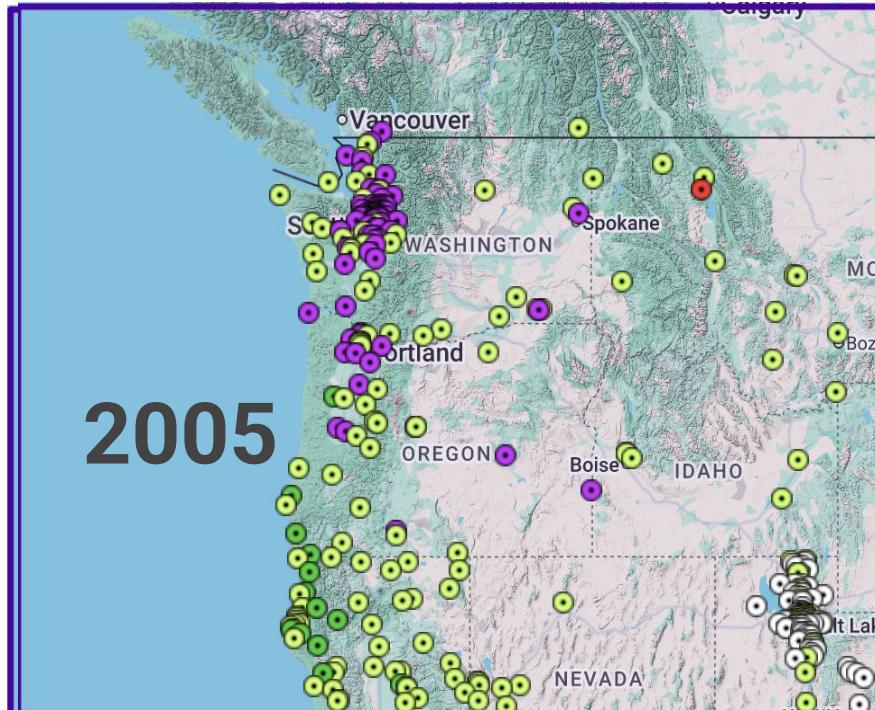
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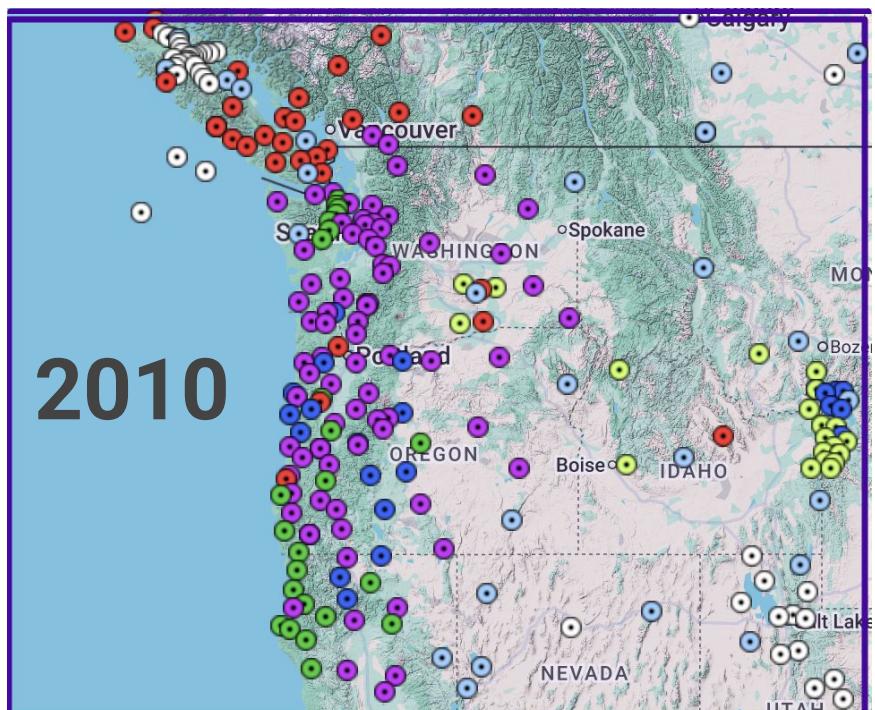
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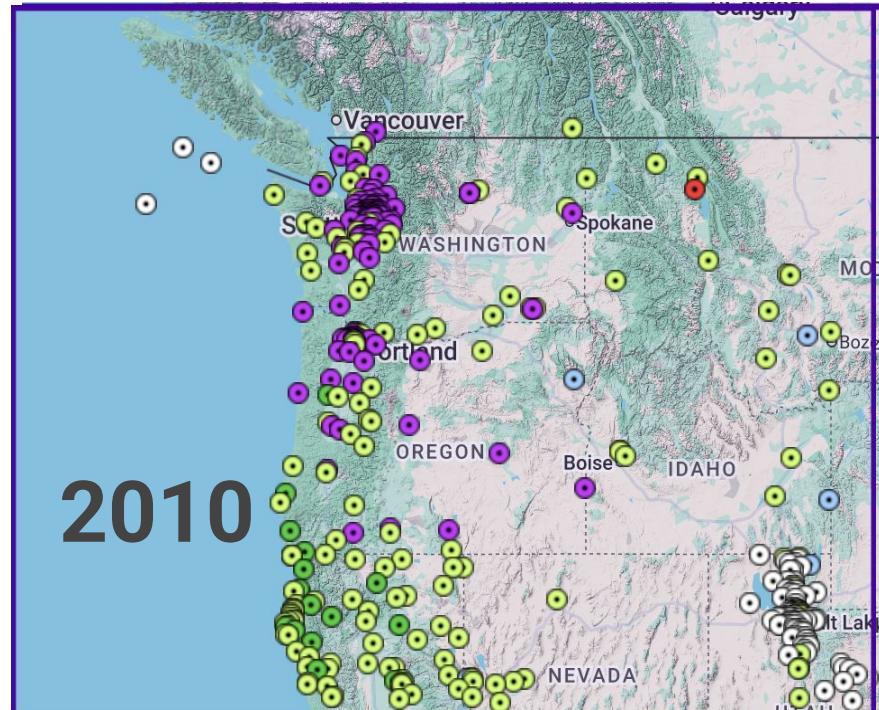
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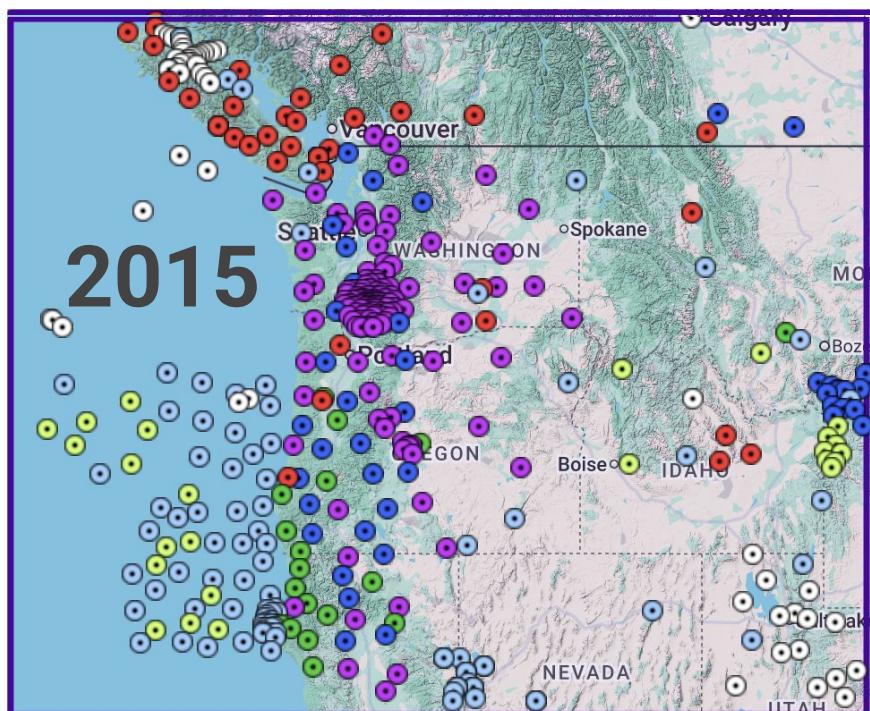
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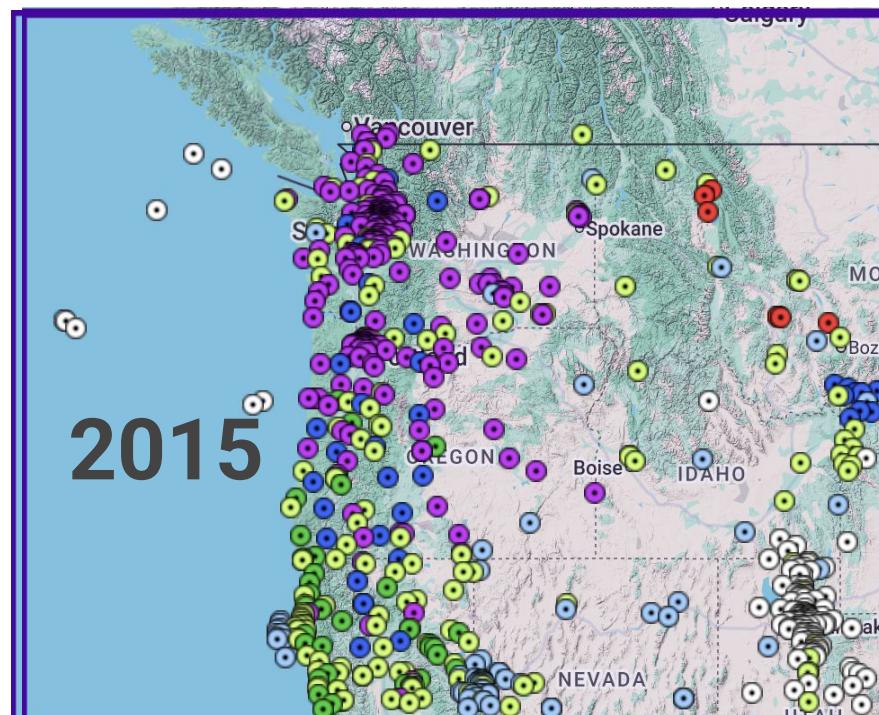
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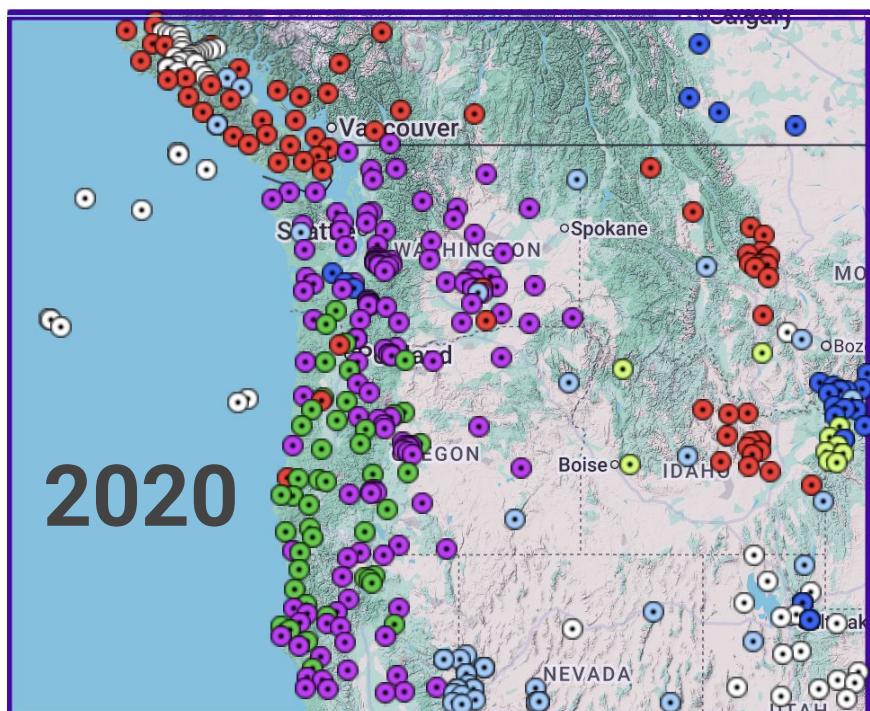
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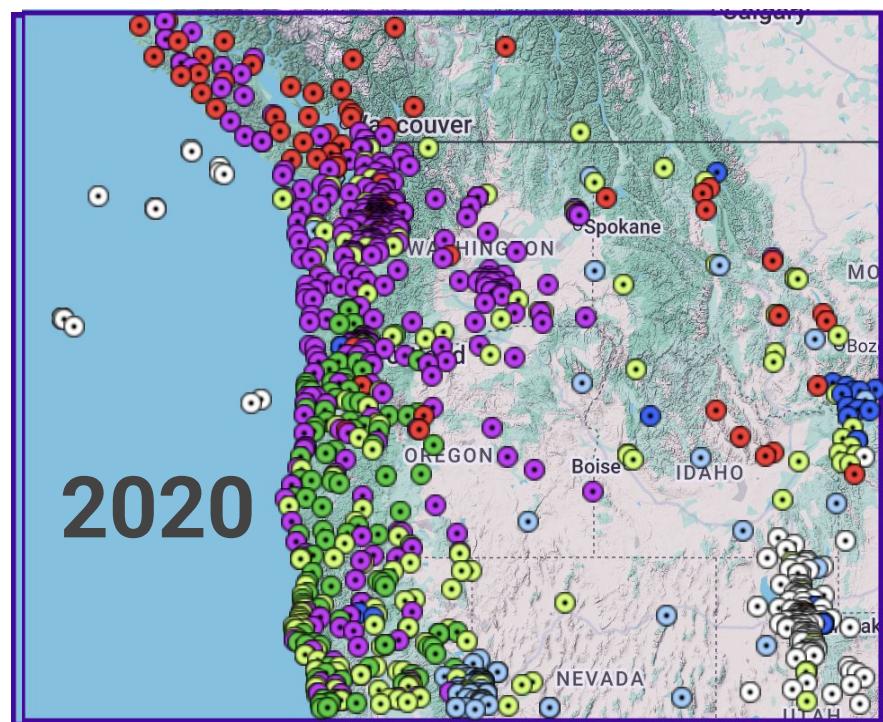
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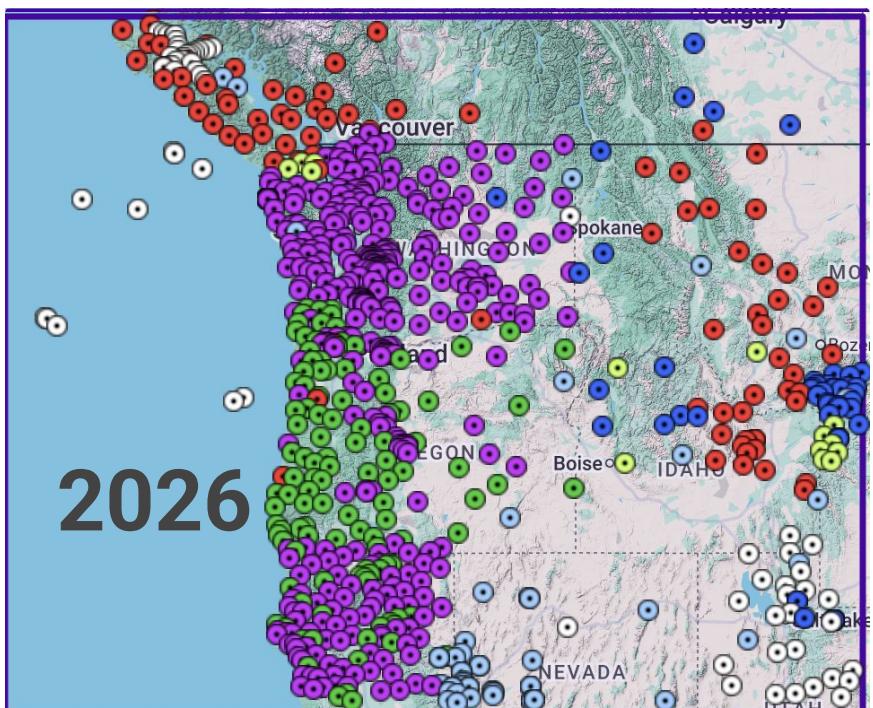
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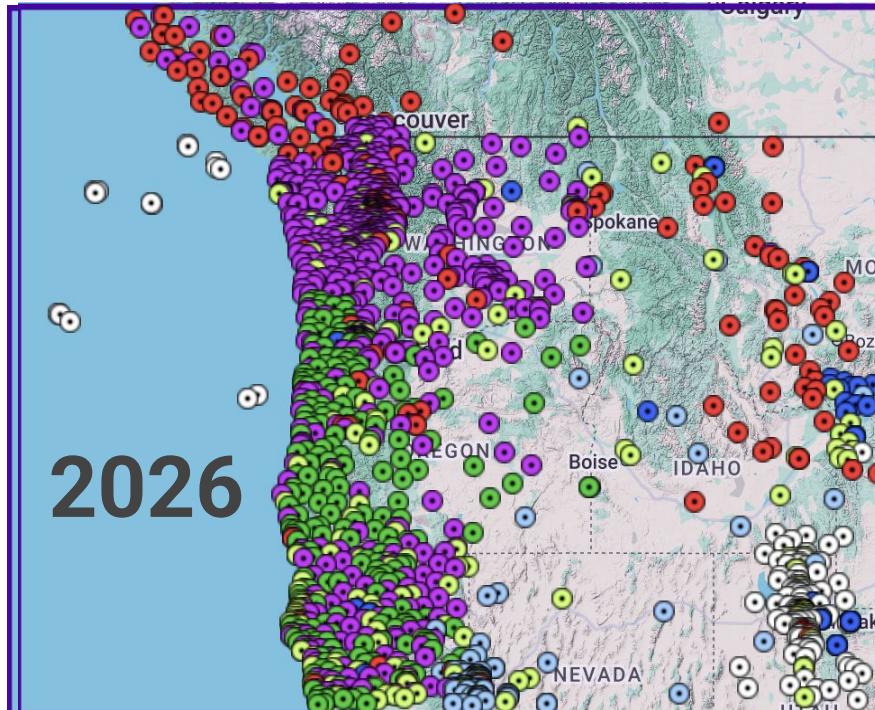
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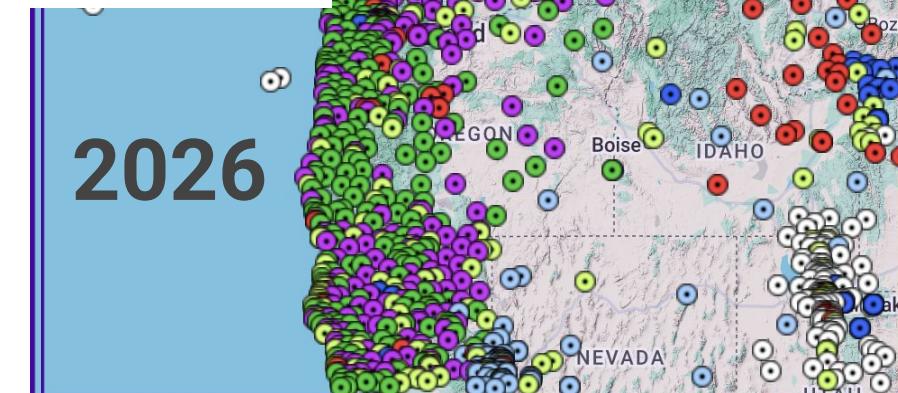
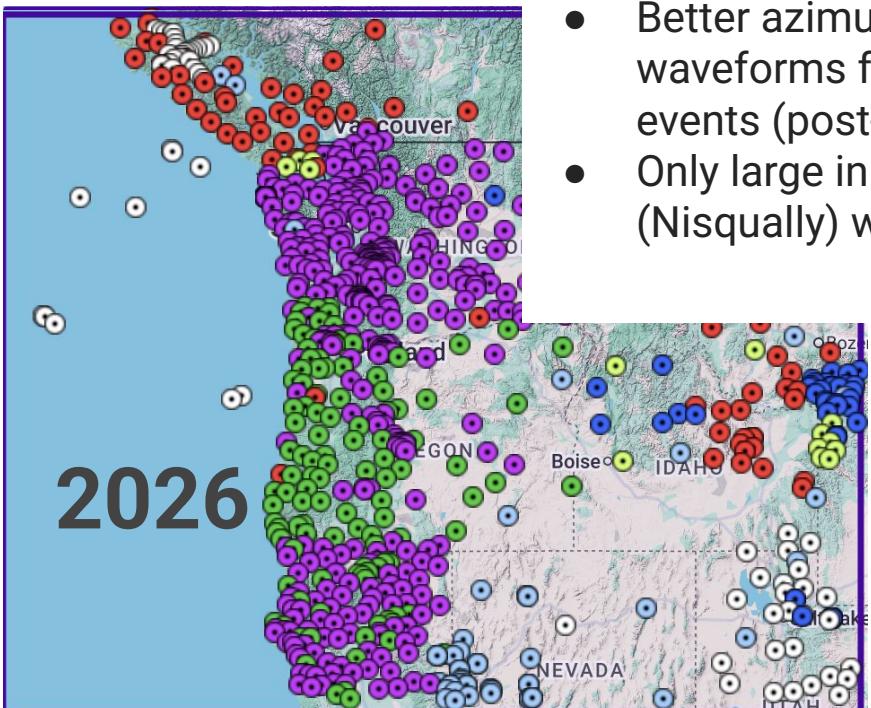


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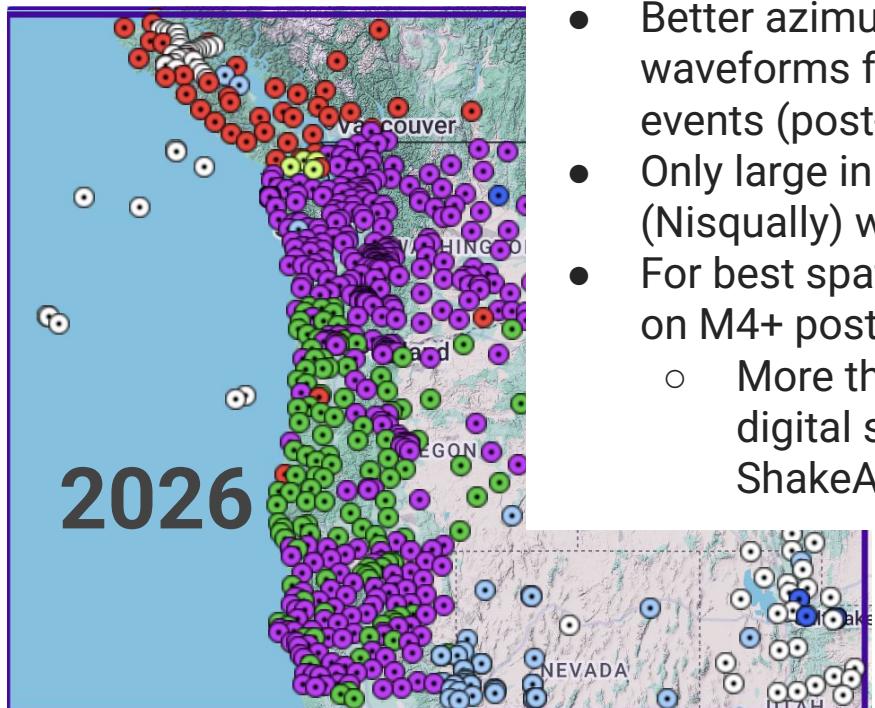
# Strong-motion sensors

In summary:

- Better azimuthal coverage for waveforms for more recent events (post-2000)
- Only large inland event (Nisqually) was 2001



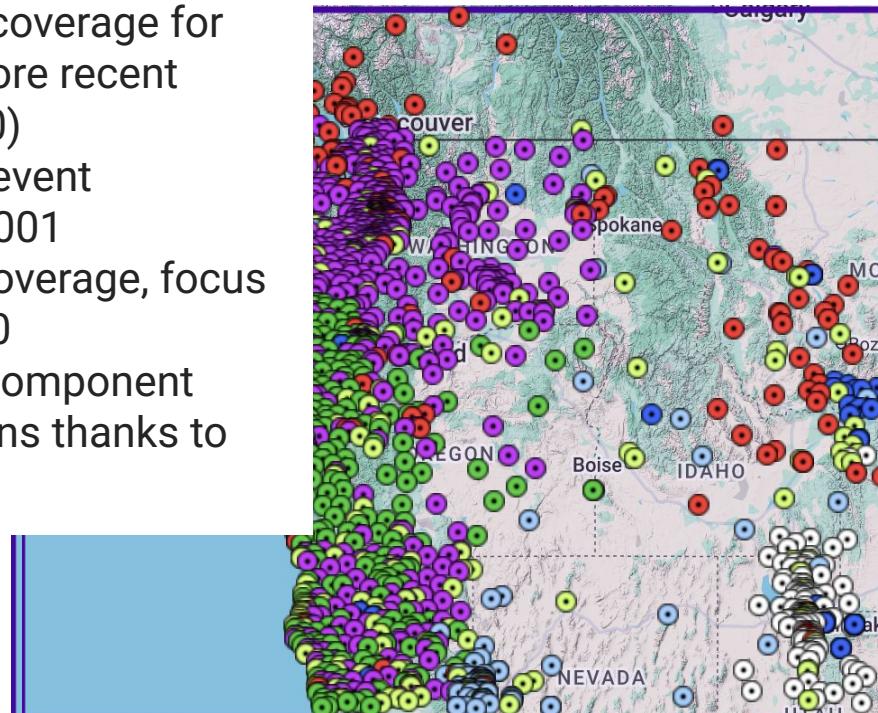
# Broadband sensors



# Strong-motion sensors

In summary:

- Better azimuthal coverage for waveforms for more recent events (post-2000)
- Only large inland event (Nisqually) was 2001
- For best spatial coverage, focus on M4+ post-2020
  - More three-component digital stations thanks to ShakeAlert



# Waveform data access

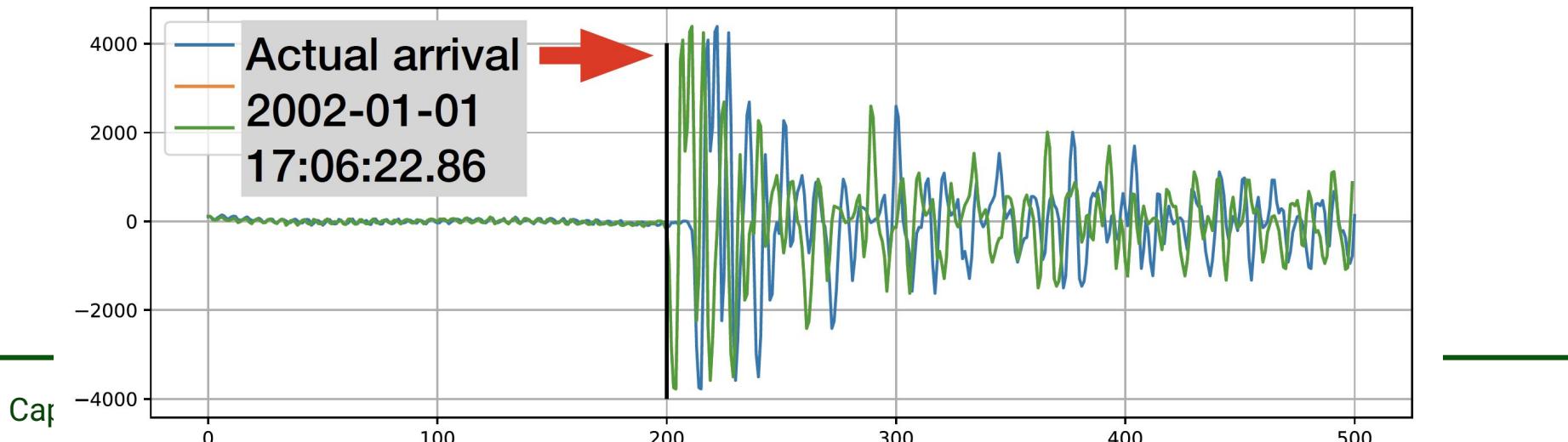
- All ANSS and Canadian data can now be retrieved via FDSN-standardized dataselect web services
- Most US data are archived at EarthScope Data Services
- Northern California data can be retrieved from NCEDC
- Canadian data can be retrieved from <https://www.earthquakescanada.nrcan.gc.ca/fdsnws/>

THANKS!  
Questions to: [jrhartog@uw.edu](mailto:jrhartog@uw.edu)

# Data questions? Contact the network!

*Caution: Obspy Stream object and unsteady clocks!*

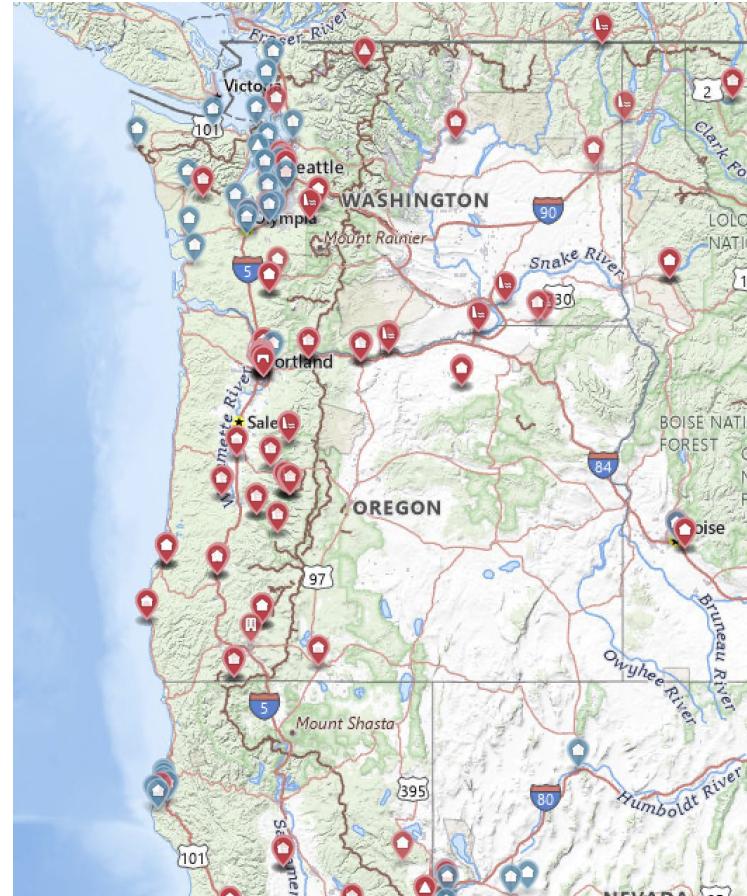
```
# read short time windows from a larger miniSEED file
s3 = obspy.read("./OBC.UW.2002.001", starttime = starttime, endtime
= endtime, nearest_sample=False)
```



# National Strong-Motion Program (NSMP)

<https://earthquake.usgs.gov/monitoring/nsmp/stations.php>

- Long-lived
- Only some stations report continuously
- Most are event-triggered



Bridge, overpass

Building

Dam

Free-field and reference

Geotechnical Array

Miscellaneous

USGS site

non-USGS site

# Authoritative regions of the ANSS US contributors

