

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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- Strong-motion Catalogs → processed for engineers


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 screenshot shows the ANSS ComCat website. At the top is the ANSS logo, which consists of the letters 'ANSS' in a large, bold, red font. The 'A' and 'N' are stylized with blue stars. To the right of the letters is a blue line graph representing a seismic waveform. Below the logo is the text 'Advanced National Seismic System' in a bold, black font. Below this is a browser address bar showing the URL 'earthquake.usgs.gov/data/comcat/'. The main content area has a dark blue header with the USGS logo and the text 'Earthquake Hazards Program'. Below this is a section titled 'ANSS Comprehensive Earthquake Catalog (ComCat) Documentation'. The text describes the catalog as containing earthquake source parameters and other products. There are two links: 'Search Earthquake Catalog' and 'Latest Earthquakes'. Below this is a 'Table of Contents' section with two columns. The left column is titled 'Data Types, Definitions, Format, Availability' and lists links for 'Data Availability', 'Data Products', 'Did You Feel It?', 'Finite Fault', 'Focal Mechanisms', 'Moment Tensors', 'Origins', 'PAGER', and 'Phase Data'. The right column is titled 'Data Access' and lists links for 'Real-time Notifications', 'ENS - Earthquake Notification Service', 'TED - Tweet Earthquake Dispatch', 'Real-time Earthquake Feeds', and 'Formats'. The 'Formats' section lists links for 'ATOM', 'CSV/Spreadsheet', 'GeoJSON Summary', and 'GeoJSON Detail'. On the left side of the page is a vertical navigation menu with links for 'Home', 'Earthquakes', 'Hazards', and 'Science'.

ANSS
Advanced National Seismic System

earthquake.usgs.gov/data/comcat/

USGS
science for a changing world

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
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earthquake.usgs.gov

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- For official Canadian event information, see NRCan



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ANSS
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earthquake.usgs.gov/data/comcat/

USGS
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- [Latest Earthquakes](#)

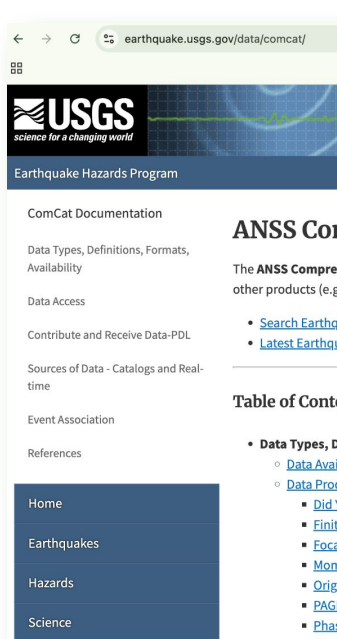
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PNW: most 3.5+ events have an ANSS ShakeMap

Larger earthquakes: ANSS also produces Finite Fault models (event parameters used for NGA projects)

earthquake.usgs.gov



Government
of Canada

Gouvernement
du Canada



MENU ▾

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

Earthquakes Canada

Recent
Earthquakes

Historic Events

Earthquake Hazard

Be Prepared!

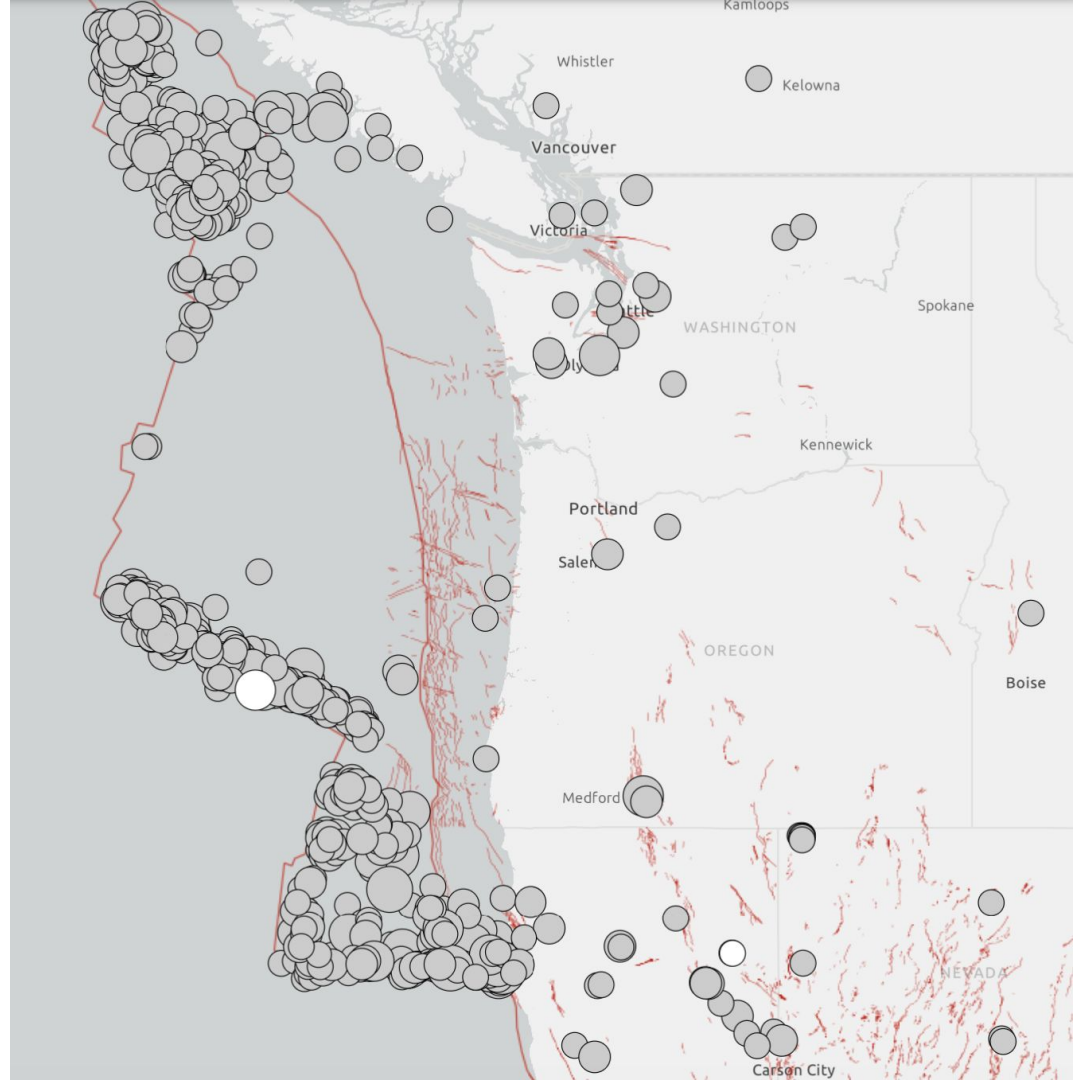
Stations and Data

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

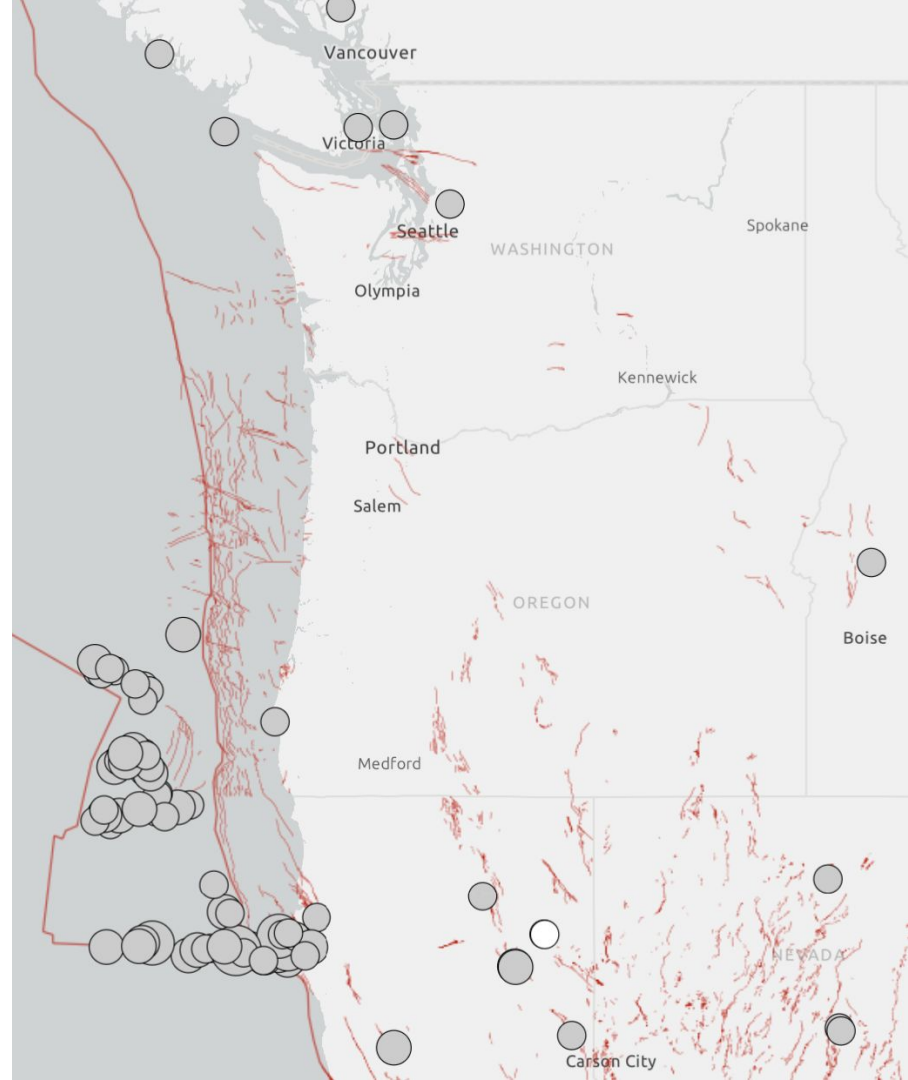
ANSS ComCat M4.5+ since 1990

- *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

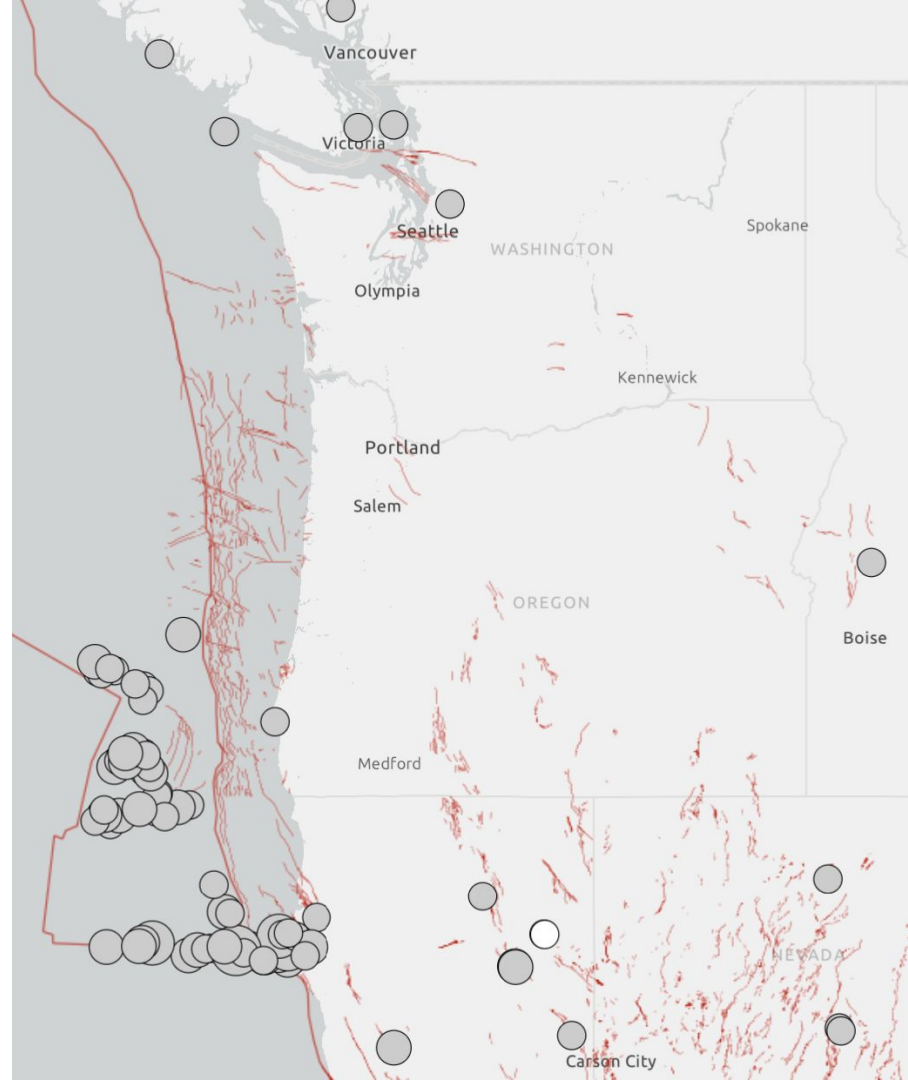
- 6 M4.5+ events in the NW
- 37 off Oregon/Northern California, including 2 at/near the coast
- 39 in the Mendocino area



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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

Event-associated strong-motion parameters

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

Earthquakes with Strong Motion Records in CESMD

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

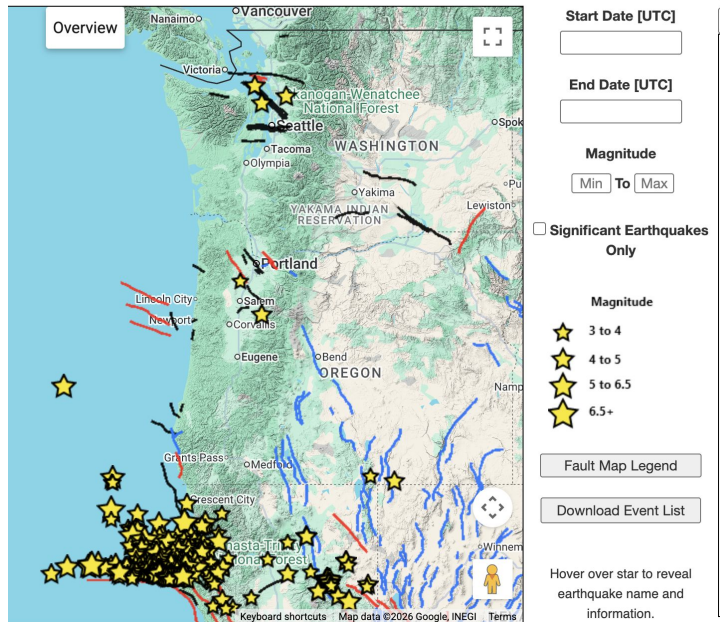
CEUS

IRIS

COSMOS

Partner Data Centers and Networks

Data Attribution and Use Policy



NGA-subduction Cascadia

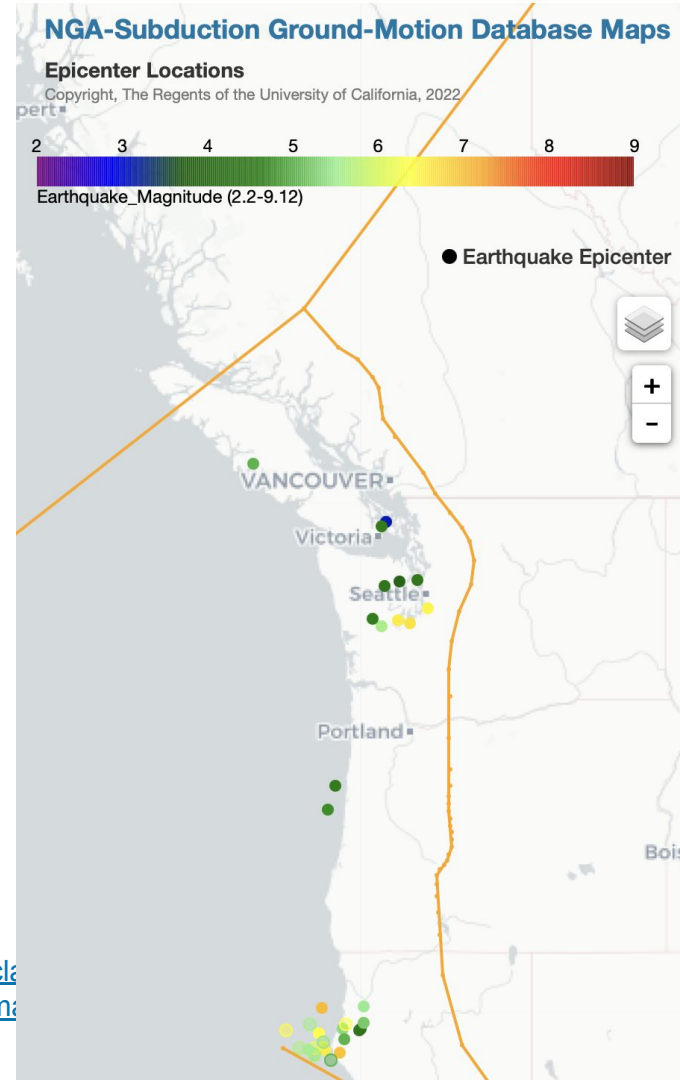
- 35 earthquakes
- M3.3-M6.8
- 1937 - 2015
- PGA, PGV, PGD
- SA 0.01s to 20s period

Many M4.5+ events and stations since 2015.

Before 2015: NGA event selection, strict criteria?

Silvia Mazzoni
(2022):
NGA-Subduction
GM Database
Interactive Maps.
The B. John
Garrick Institute for
the Risk Sciences.
Dataset.
<https://doi.org/10.34948/N3NP49>

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



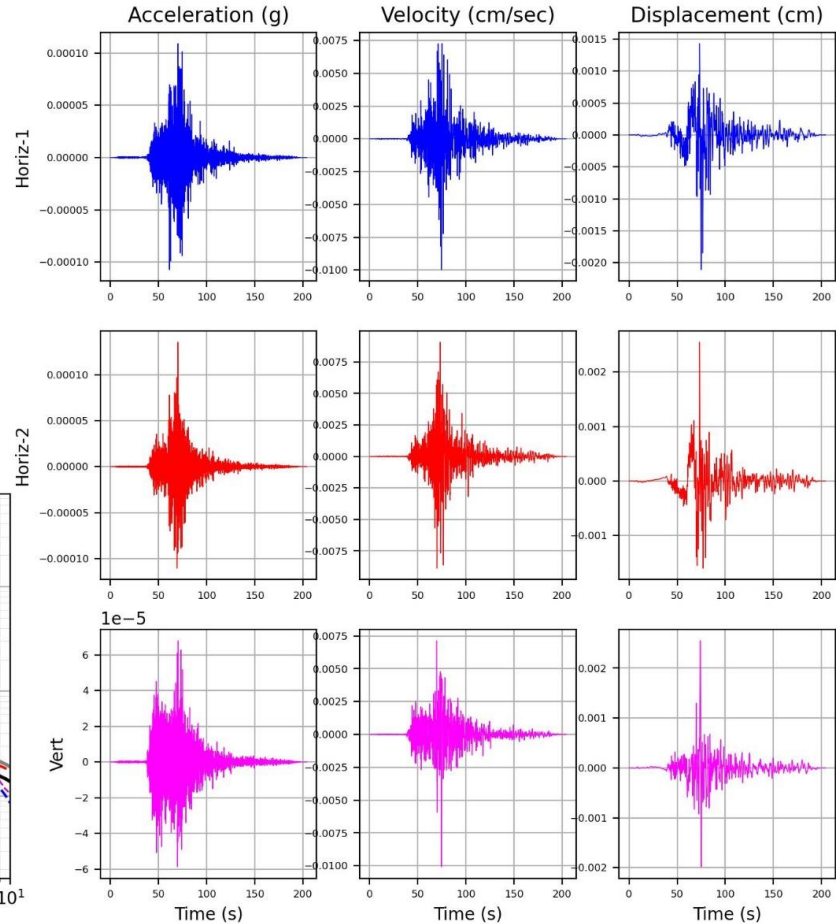
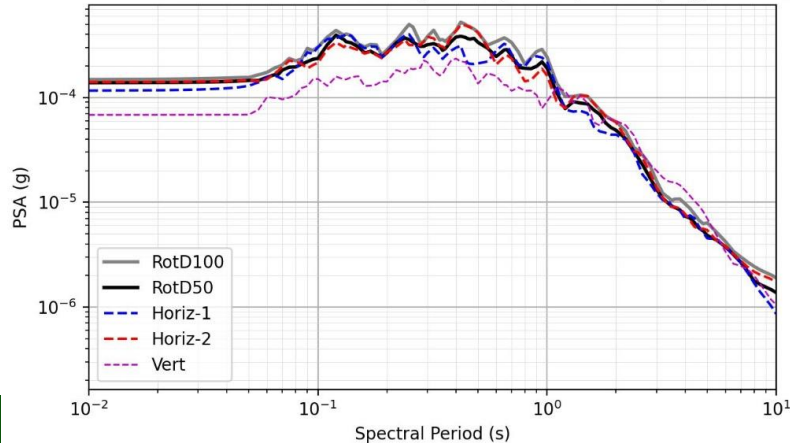
Example of NGA-Subduction data processing

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: 2000972
StationDatabaseRegion: Cascadia
Station_Name: PGC
Vs30_Selected_for_Analysis_m_s: 455
ClstD_km: 217.839
Lowest Useable Period (s): -999.0
Highest Useable Period (s): 30.348
Filename Horiz-1: NGASubRSN2001673_PGCBHE
Filename Horiz-2: NGASubRSN2001673_PGCBHN
Filename Vert: NGASubRSN2001673_PGCBHZ

Natural Hazards Risk and Resiliency Research Center (NHR3)
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NGASubRSN-2001673 Response Spectra (5%damping)

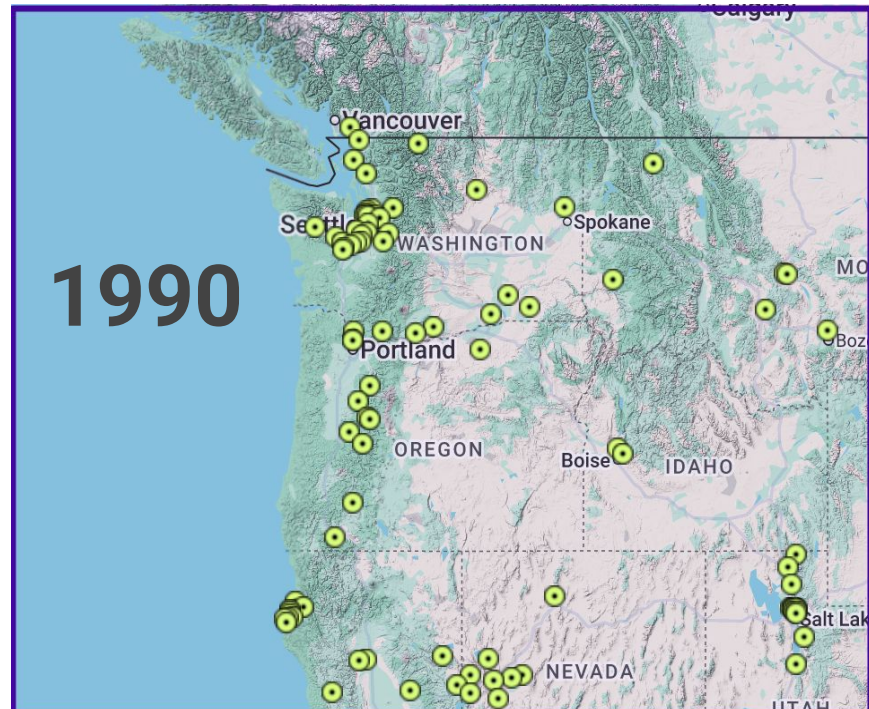


Seismic data density and quality
has dramatically improved over
time

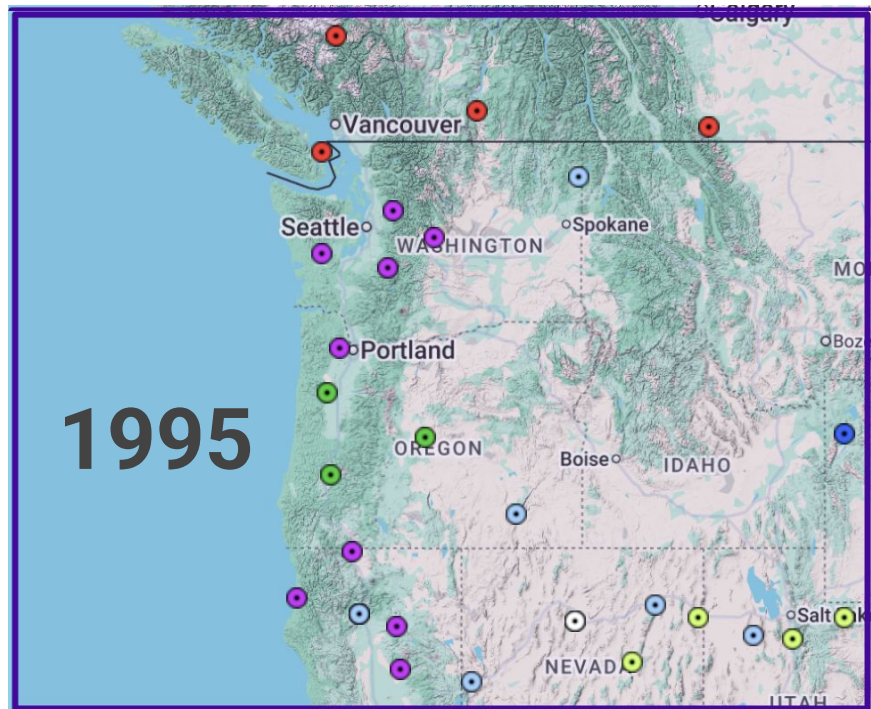
Broadband sensors



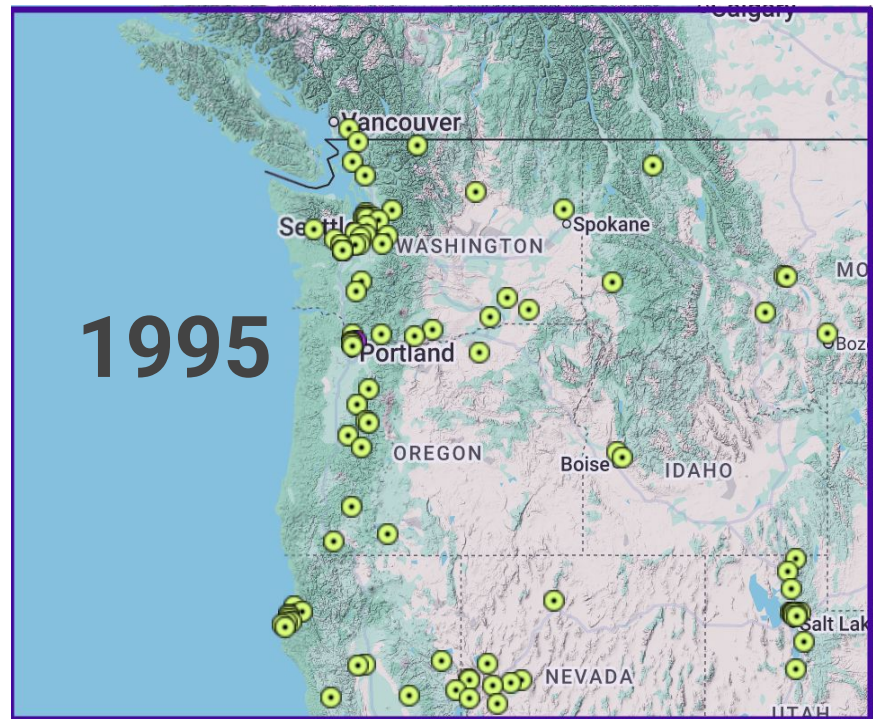
Strong-motion sensors



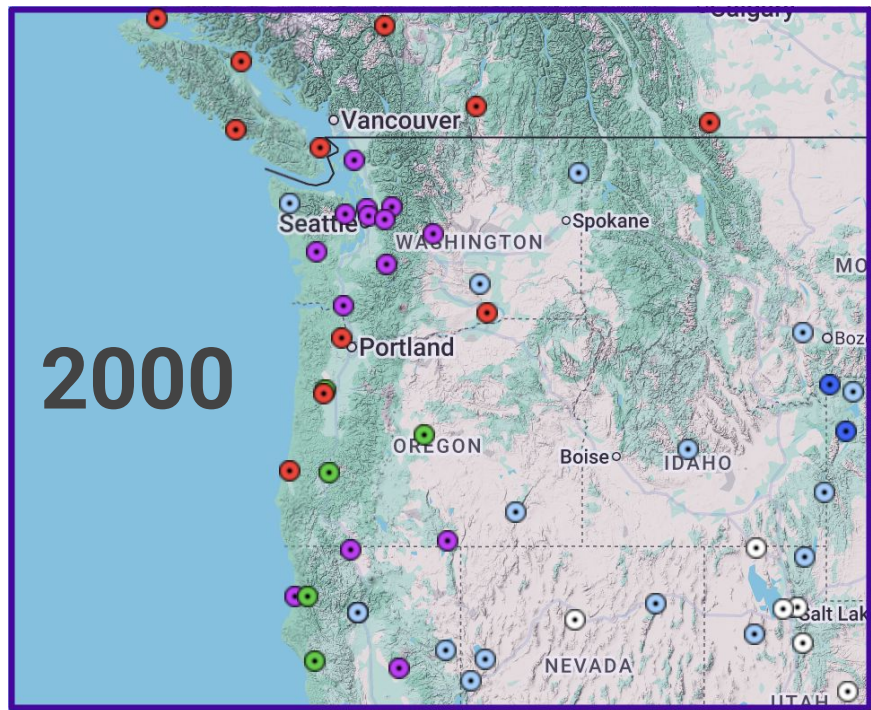
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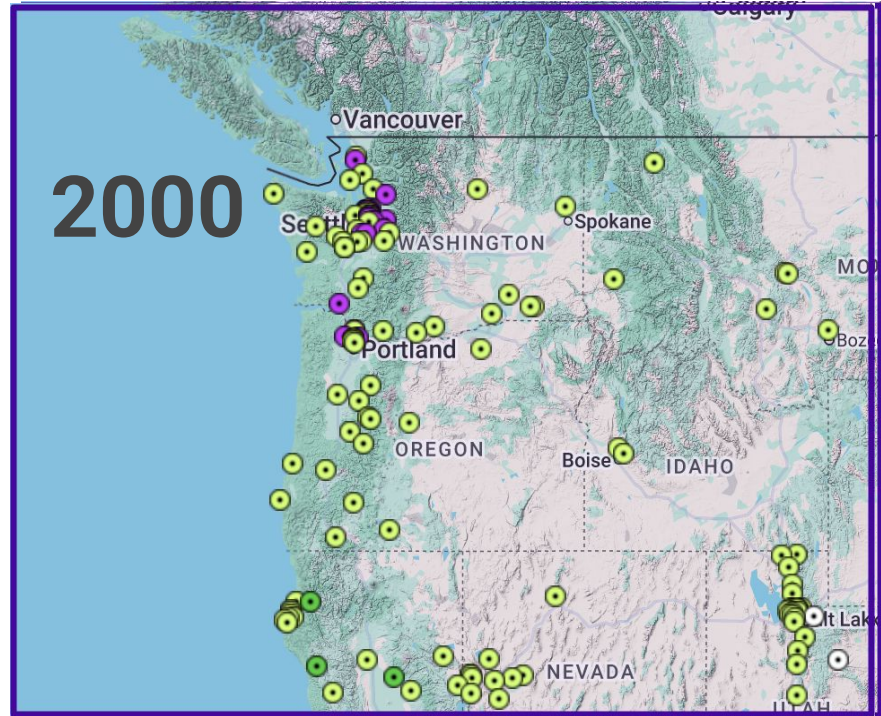
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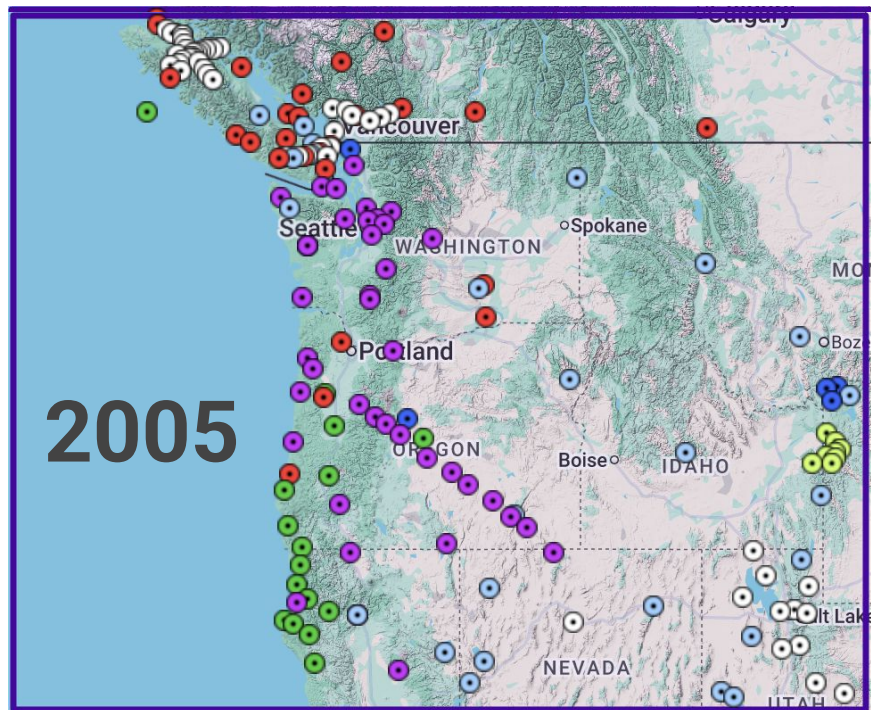
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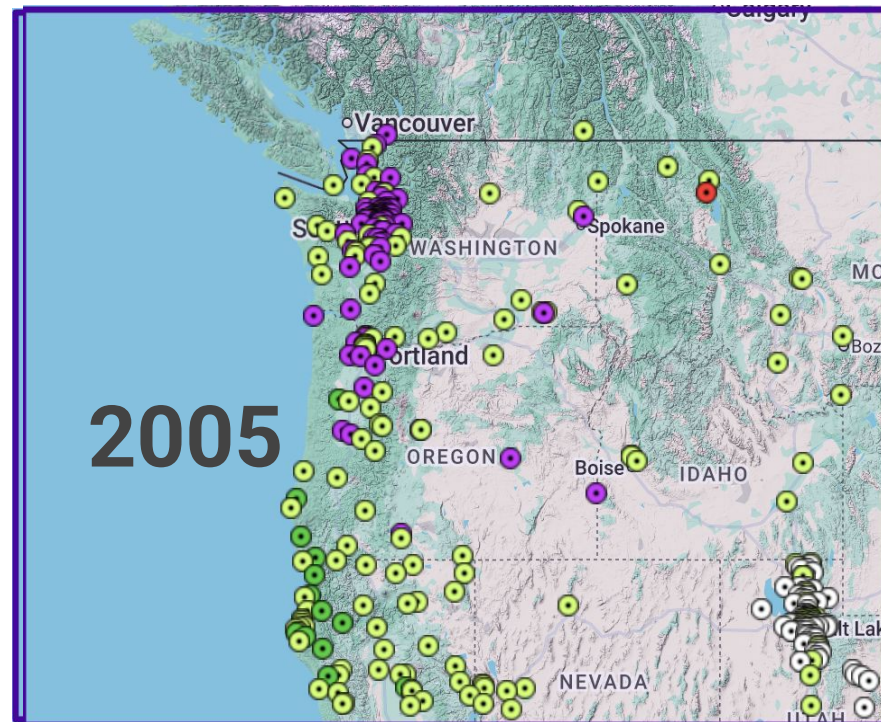
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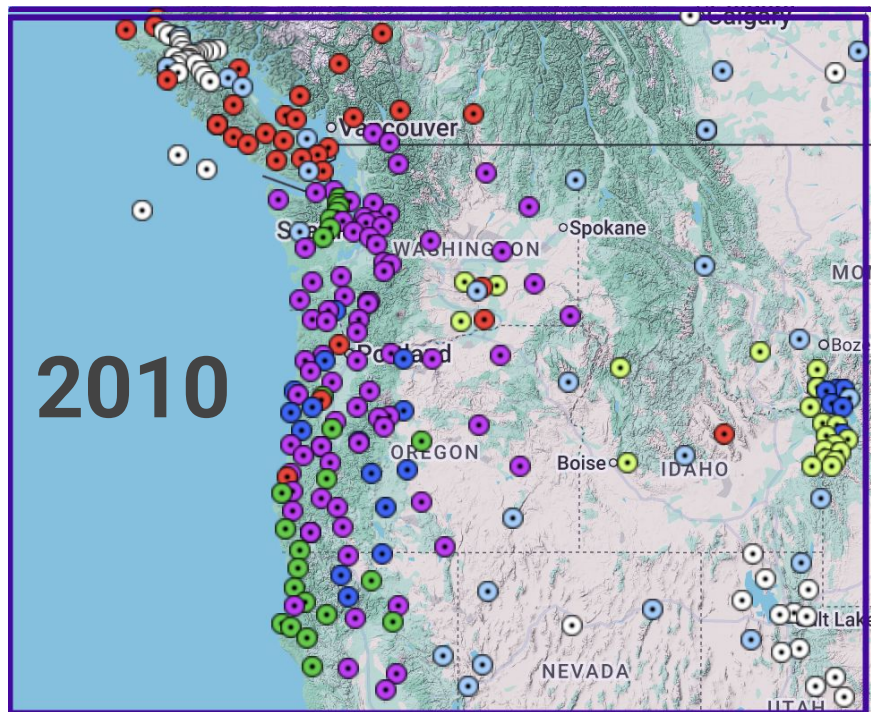
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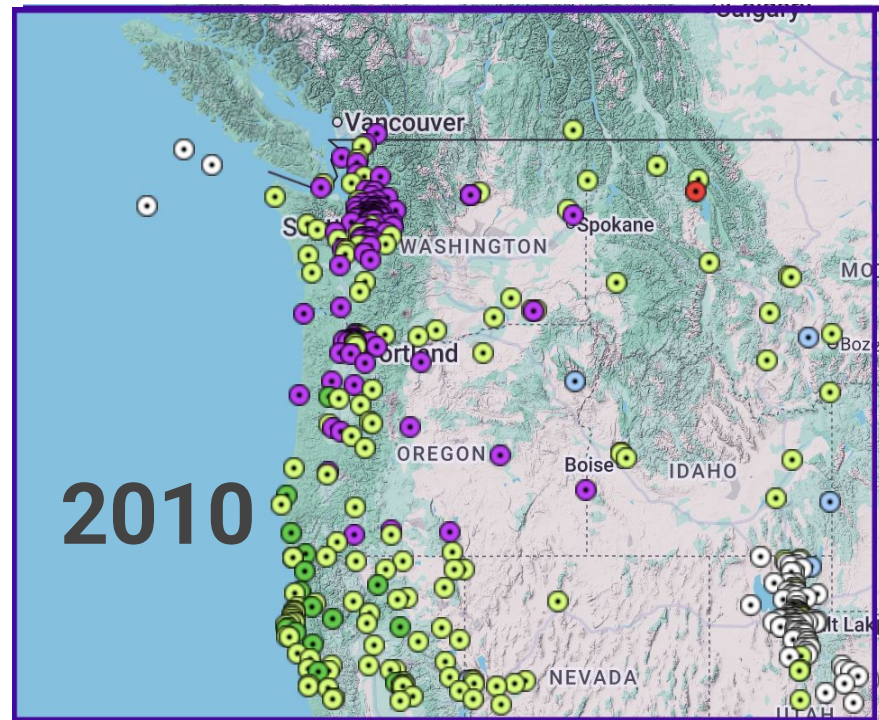
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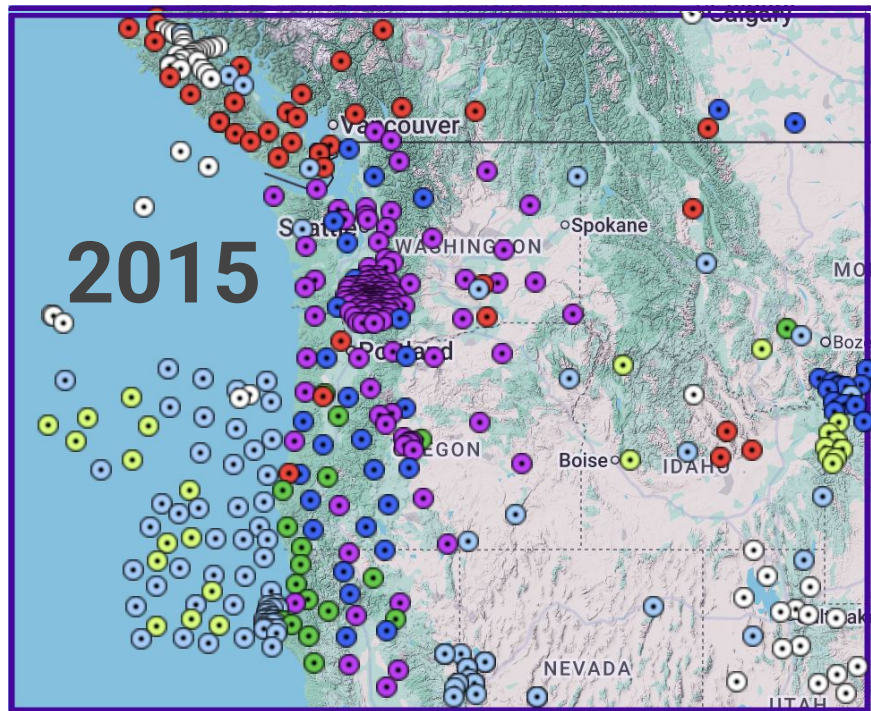
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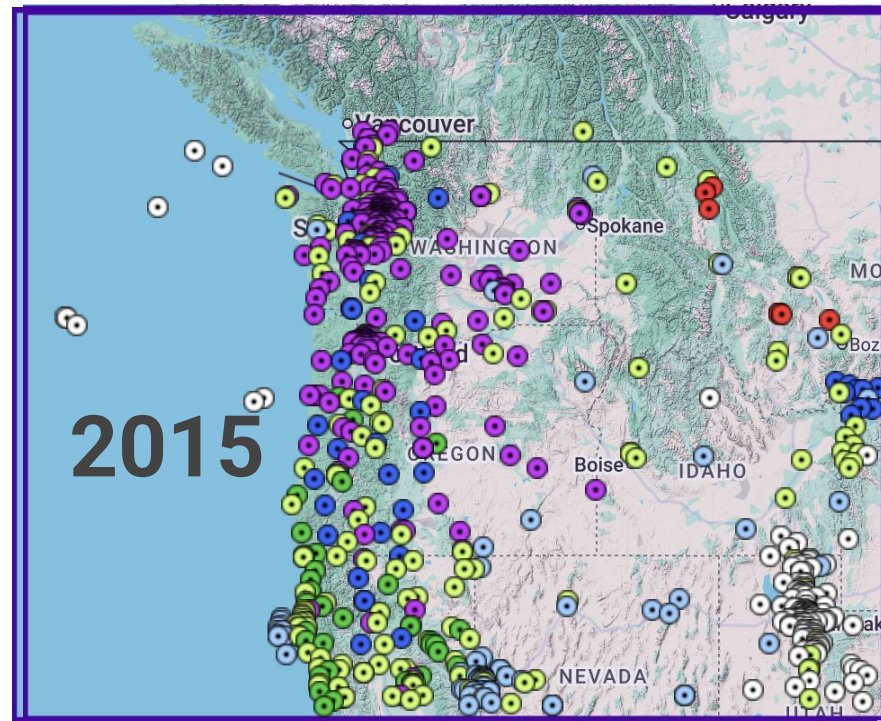
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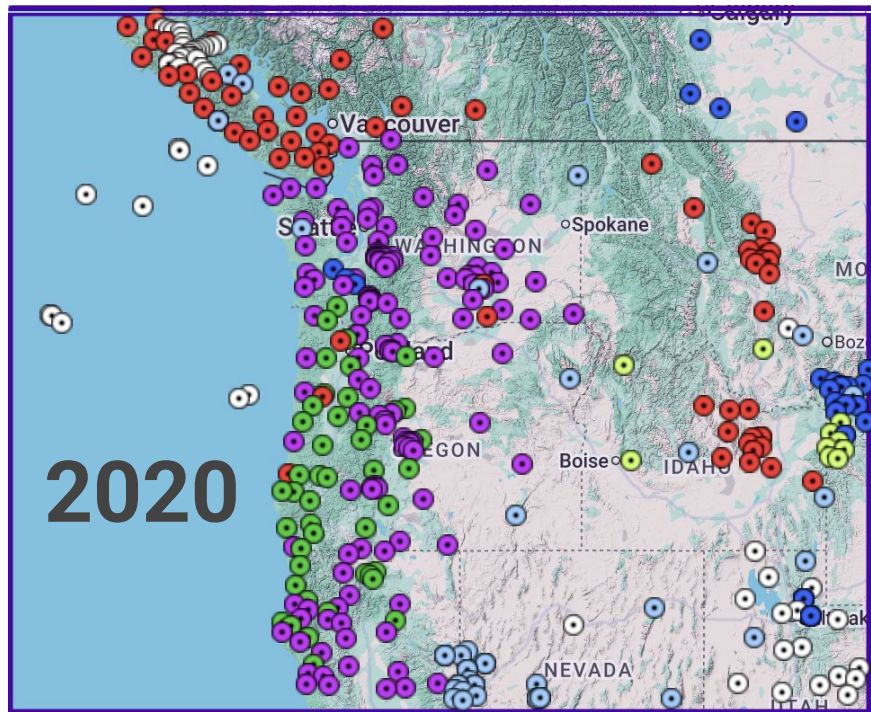
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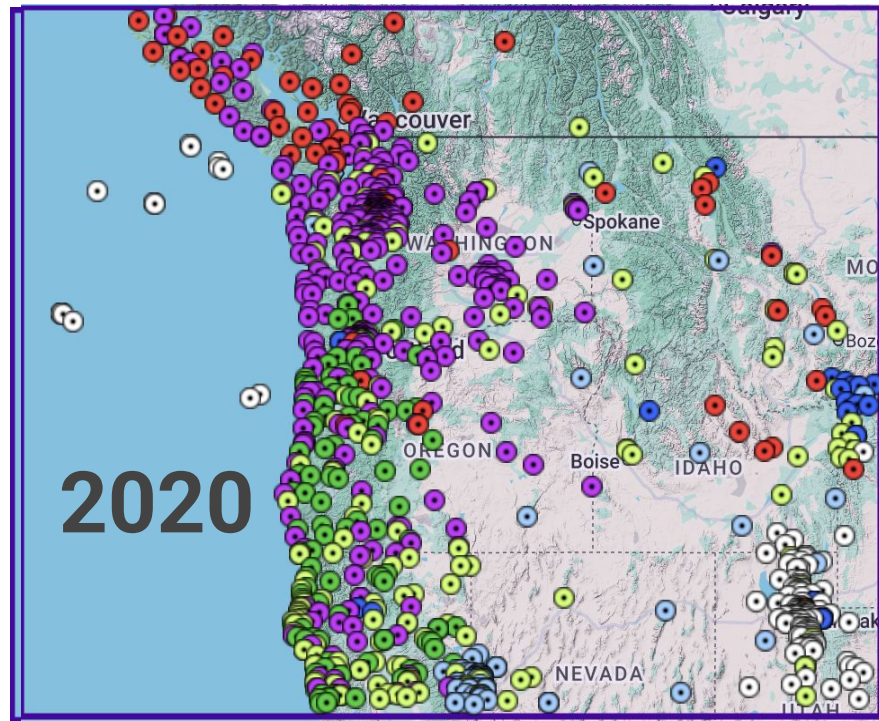
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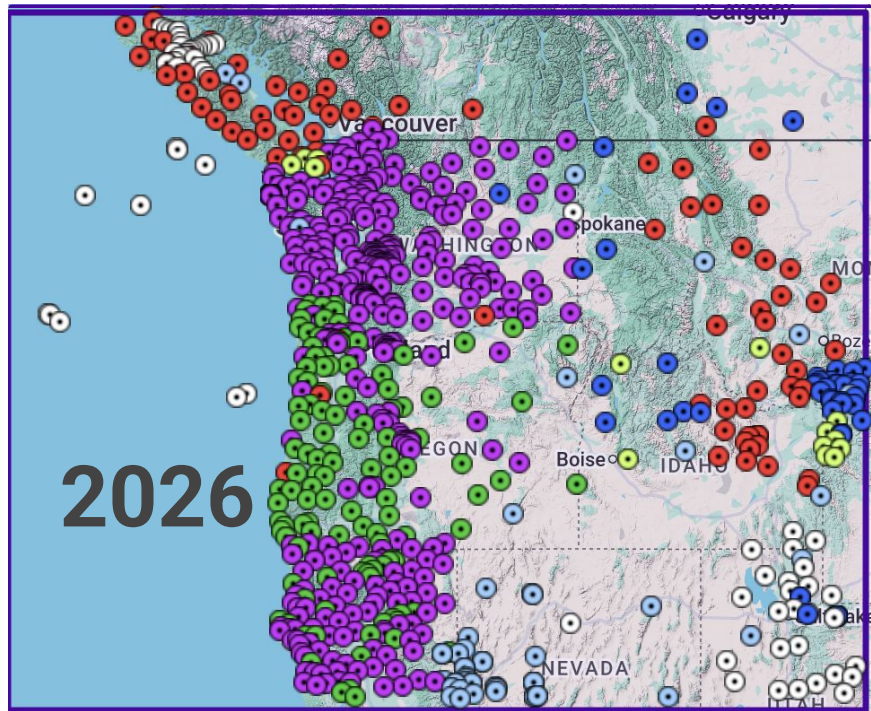
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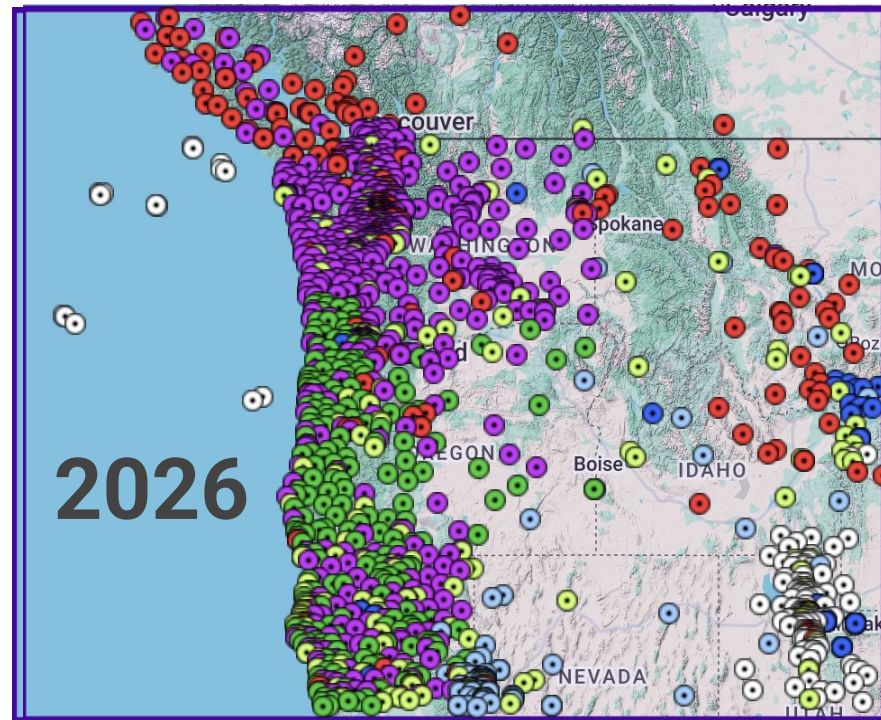
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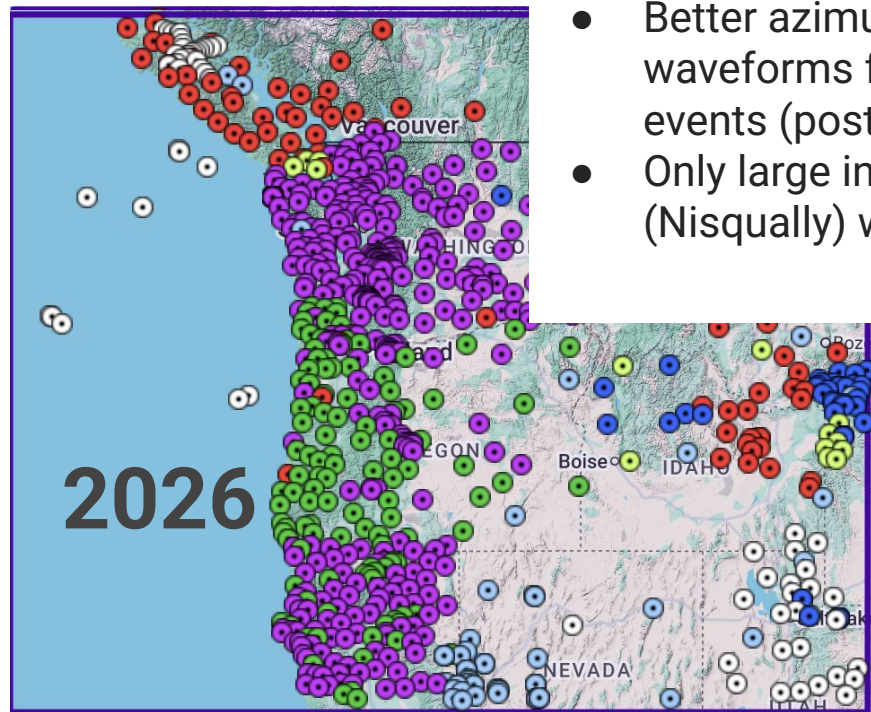
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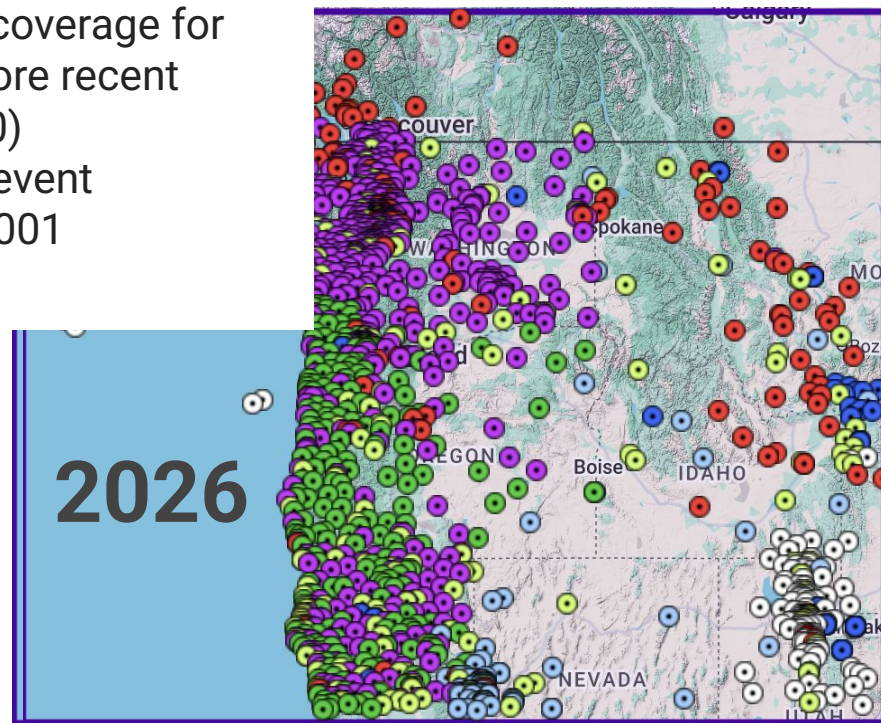
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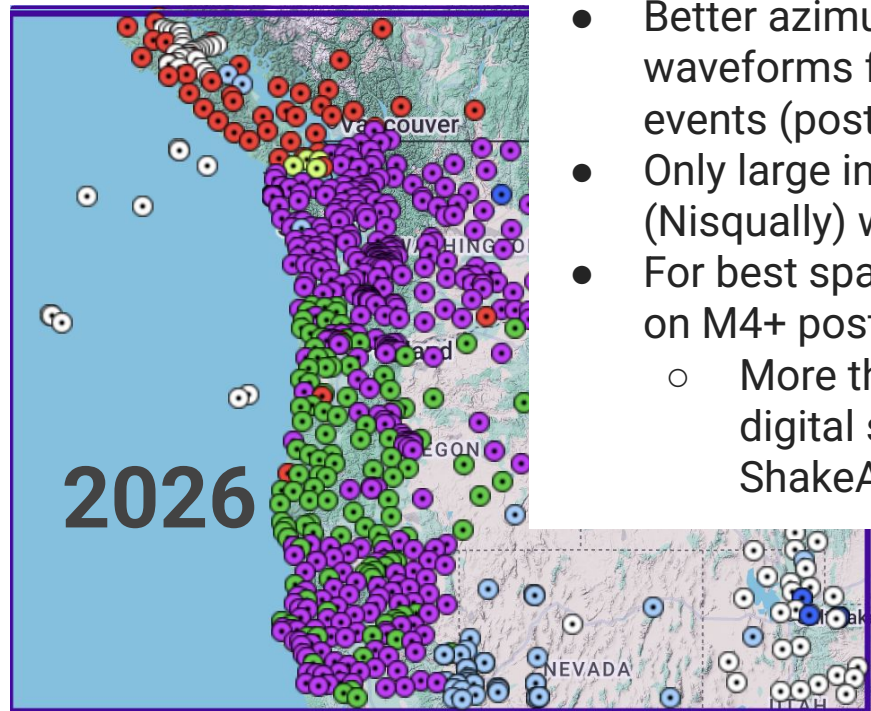
In summary:

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

Strong-motion sensors



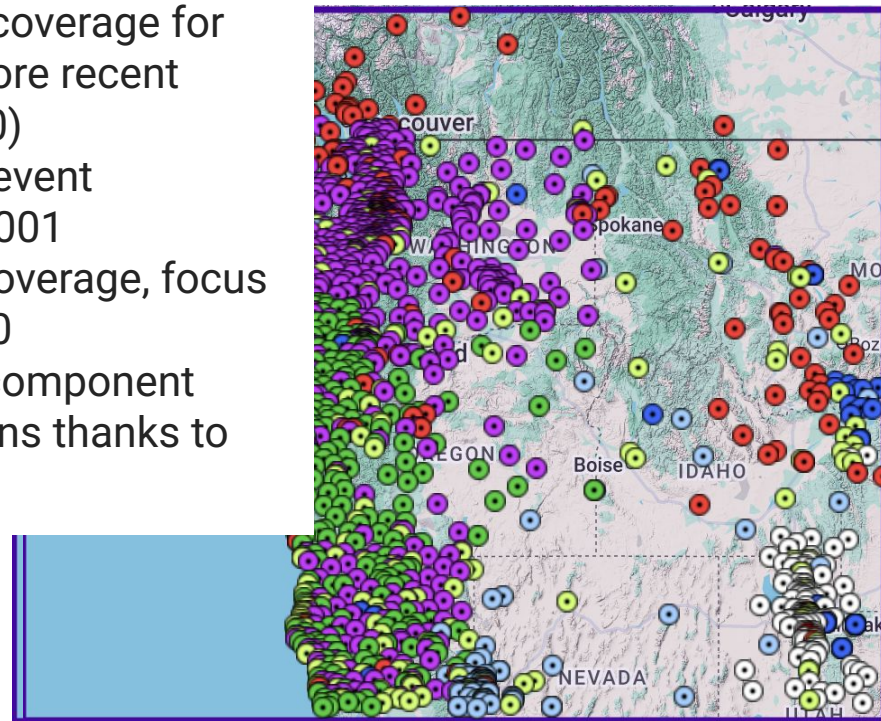
Broadband sensors



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

Strong-motion sensors



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/>

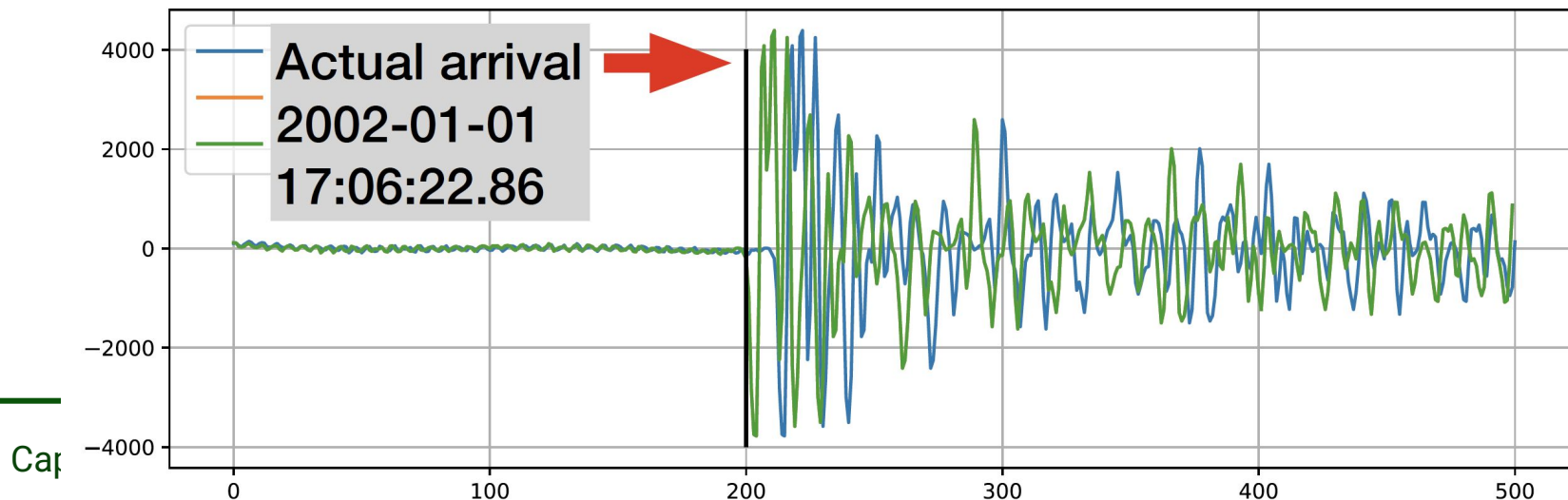
THANKS!

Questions to: jrhartog@uw.edu

Data questions? Contact the network!

Caution: Obspy Stream object and unsteady clocks!

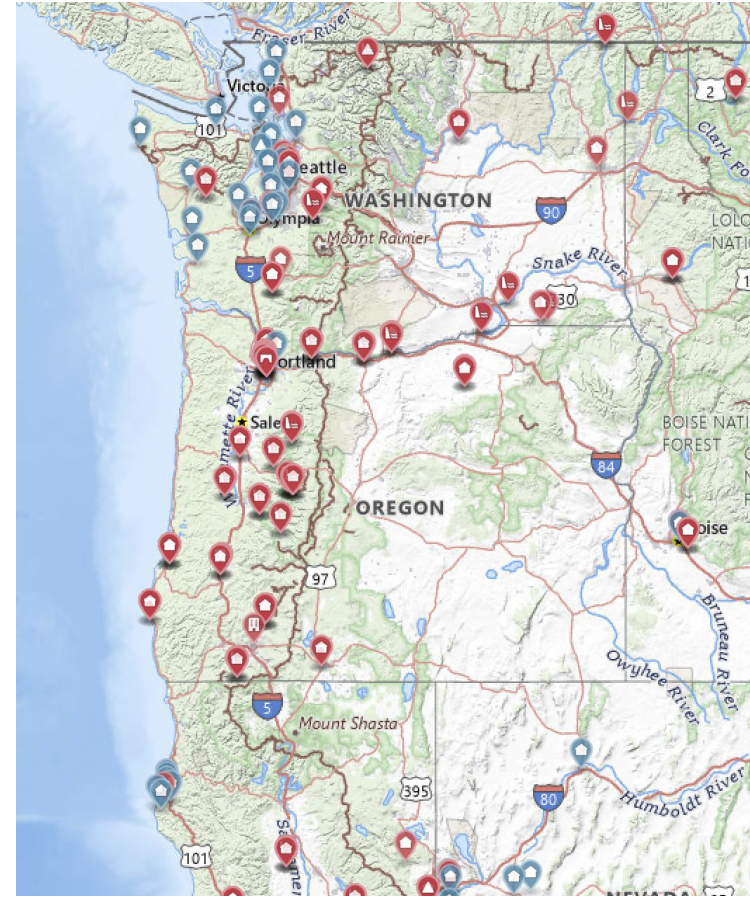
```
# read short time windows from a larger miniSEED file  
s3 = obspy.read("./OBC.UW.2002.001", starttime = starttime, endtime  
= endtime, nearest_sample=False)
```



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

