

PACIFIC NORTHWEST SEISMOGRAPH NETWORK OPERATIONS

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S.D. Malone, R.S. Crosson, and A.I. Qamar, P.I.s

Geophysics Program, University of Washington

Seattle, WA 98195

Phone:(206)543-8020 FAX:(206)543-0489

e-mail: steve, bob, tony, or ruth@geophys.washington.edu

URL: <http://www.geophys.washington.edu/SEIS/PNSN/>

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Non-technical Summary

The Pacific Northwest Seismograph Network ([PNSN](#)) operates seismograph stations in Washington and Oregon, and collects and analyzes earthquake data. Between Oct. 1, 1999 and Sept. 30, 2000 the PNSN analyzed 5,482 events. Of these, 4,379 were earthquakes or blasts within the network (1,758 of which were too small to locate). Within the network area, 1,843 tectonic earthquakes were located west of 120.5 degrees west longitude (including 628 in the general vicinity of Mount St. Helens, which has not had a magmatic eruption since 1986), and 252 east of 120.5 degrees west longitude. The remaining events were blasts within the network, regional earthquakes (365), teleseisms (738), or small surficial earthquakes (251), mostly near the summit of Mt. Rainier. During the third quarter of 2000 a temporary station (RSU) operating at the summit of Mt. Rainier made it possible to record many more small surficial Rainier events than usual.

Between Oct. 1, 1999 and Sept. 30, 2000, 9 earthquakes were reported felt in Washington west of the Cascades, ranging in magnitude from 1.2 to 3.7. No earthquakes were reported felt east of the Cascades, and eight earthquakes (magnitudes 2.5 to 4.1) were reported felt in Oregon.

Network Operations

The Pacific Northwest Seismograph Network ([PNSN](#)) operates 132 short-period, broad-band, or strong-motion seismometer stations west of 120 degrees west longitude under this agreement, and 38 additional stations under other support. Some stations include up to 6 components. PNSN stations in southern and central Oregon are maintained by the University of Oregon under Cooperative Agreement [HQ98AG01928](#). The PNSN exchanges real-time data with adjacent networks to improve our ability to locate earthquakes on the edge of our network. The PNSN records and assists with the maintenance of several short-period stations operated by the USGS, and receives real-time data from four US National Network (USNSN) stations in Washington and Oregon

- [Figure 1](#). Seismograph stations operated by or recorded at the PNSN at the end of September, 2000. Red triangles indicate the locations of short-period

seismometers, while green hour-glass symbols represent the locations of three-component broad-band seismometer installations. Purple squares show the locations of strong-motion stations.

A PNSN seismologist is always available on-call, and our standard procedure is to respond to pager messages from our automatic earthquake detection process (initiated for any earthquake within our network of magnitude 2.9 or larger), or calls from Washington or Oregon emergency management agencies or the UW police. PRELIMINARY information for earthquakes of $M \geq 2.9$ is sent out automatically by the event detection process. Emergency managers and other high-priority information users receive very rapid notification through the RACE pager-PC system, faxes and e-mail. Simultaneously, an automatic Web-site is created for the event (see http://www.geophys.washington.edu/SEIS/EQ_Special/lstegq.html).

FINAL details are provided as soon as the duty seismologist analyzes the earthquake information. Final locations and magnitudes for earthquakes of $M \geq 2.9$ are also disseminated through the NOAA emergency notification system.

For all earthquakes, updates of information are posted to Web-pages each time the analyst finalizes a group of locations and magnitudes. In addition to ordinary phone lines, the PNSN has a radio link to the Washington State Dept. of Emergency Services, and an independent direct phone link to the City of Seattle Emergency Operations Center.

The PNSN has implemented "Recent Earthquakes" web pages using the national "Quake Data Delivery System" that allows networks to share information and improve the timeliness and accuracy of the "Recent Earthquakes" pages. We also began participating in the USGS web-based collection of earthquake felt reports (Community Internet Intensity Maps). Although the PNSN collected web-based felt reports on its own for several years, the USGS has historically been responsible for collecting, compiling, and interpreting U.S. earthquake intensity data.

- ***The PNSN Strong Motion Program:*** Since 1996, the PNSN has installed digital strong-motion instruments, mostly in the Puget Sound urban area. In summer, 2000, 22 new instruments were installed, bringing the total number of PNSN strong-motion instruments to 42. Continuous data from these stations are sent to the PNSN via Internet or lease-line modem, but the instruments also have a trigger set to record stronger events on-site. If continuous data transmission fails, the data will still be available via dial-up retrieval or site visit. Three additional dial-up stations are operated by the USGS in the Portland area. Highlights this year include the upgrade of two stations to meet CREST (Consolidated Reporting of EarthquakeS and Tsunamis) standards, and installation of an EARTHWORM data acquisition node in the Portland area.

- ***Data Availability:*** All triggered network trace-data in raw unedited format, plus continuous telemetry several selected broadband data and short-period stations and processed data for each event, are backed up on network archive tapes. Edited event trace-data are archived on large disks, and kept on 2.1 GByte exabyte tape. We archive

the edited trace-data at the University on high-speed, high-capacity (20 GByte) digital linear tape (DLT) cartridges and at the IRIS Data Management Center (DMC) in SEED format, where they can be retrieved by any investigator via the standard IRIS data request mechanisms.

- ***Education and Outreach:*** Staff from the PNSN provide an educational outreach program to better inform the public, policy makers, and emergency managers about seismicity and natural hazards. In addition to information sheets, lab tours, workshops, and media interviews, we have an audio library with several tapes, including a frequently updated message on current seismic activity. Similar, more comprehensive, information is available via Internet on the World-Wide-Web (WWW):

<http://www.geophys.washington.edu/SEIS/>

The installation of strong-motion instruments is also encouraging the formation of research relationships with a wide range of organizations who are interested in the data collected and the potential for useful data products. These organizations, in turn, can provide the PNSN with station sites and/or telemetry. We anticipate that cooperative efforts will contribute to more robust and diversified network telemetry, additional non-federally funded strong motion seismograph stations, and increased support for critical staff.

- ***Special Events:***

- A special one-evening program was held at the UW's Burke Museum on January 26th to commemorate the 300th anniversary of the last great Cascadia Subduction Zone earthquake. (The exact date, January 26, 1700, is known from historic records of a destructive tsunami which struck Japan.) An award from Washington Governor Gary Locke was presented to the Japanese scientist who compiled evidence of this tsunami. More than 40 scientists, including PNSN staff and USGS and NOAA scientists displayed posters on current earthquake research and spoke informally with members of the public. The Burke Museum is working to develop a related exhibit, to open in the summer of 2002.
- "Kingdome SHIPS", the third phase of the U.S. Geological Survey's (USGS) SHIPS (Seismic Hazards in Puget Sound) active seismic experiment took place on Sunday, March 26. On the morning of March 26 the Kingdome, a large concrete sports stadium located on landfill just a few blocks south of downtown Seattle, was demolished by an implosion. The USGS deployed about 200 seismometers, with approximately 1 km grid spacing, throughout the city of Seattle (from Boeing Field in the south to Green Lake in the north) to record the event, which had an estimated magnitude of 2.3. The USGS also set off four small shots in Seattle City Parks the night before, to supplement the data recorded. The PNSN assisted with logistic support and public information activities, including over 100 press contacts, meetings with City of Seattle Public Information Officers, and staffing the PNSN Seismology Lab from 3AM - 10AM on the day of the shots and implosion.

- The PNSN and USGS cohosted several meetings. On Jan. 21 about 15 west-coast network operators and USGS researchers met at the UW to discuss real-time strong motion networks. On Jan. 26, about 40 researchers met to review current research on the Seattle fault. This meeting was the same day as the special evening event at the Burke Museum, and many of the scientists participated in both events. A two-day meeting on March 30 and 31 covered earthquake hazards in Washington and Oregon and was attended by about 75 participants, including engineers, lifeline providers, and scientists.
- The PNSN coordinated an organizational meeting for Pacific Northwest earthquake data users and providers on June 15-16. This group will advise PNW activities of the Advanced National Seismic System (ANSS).

Seismicity

Between Oct. 1, 1999 and Sept. 30, 2000, 20 earthquakes were reported felt in Washington west of the Cascades, ranging in magnitude from 1.7 to 5.1. Seven earthquakes (magnitudes 2.5 to 3.2) were reported felt in Oregon. No earthquakes were reported felt east of the Cascades, Table 1 gives the locations, depths and magnitudes of earthquakes reported felt, and Figure 2 shows earthquakes of magnitude 2.0 or larger located in Washington and Oregon during this reporting period.

- [Figure 2](#). Earthquakes magnitude 2.0 or larger between Oct. 1, 1999 and Sept. 30, 2000. Locations of a few cities are shown as white-filled diamonds. Earthquakes are indicated by red circles or green squares; red circles represent earthquakes at depths shallower than 30 km, and green squares represent earthquakes at 30 km or deeper.

TABLE 1-- FELT EARTHQUAKES 10/1/99-9/30/00

DATE-TIME is in Universal Time (UTC) which is PST + 8 hours.
Magnitudes are reported as local magnitude (Ml).
QUAL is location quality A-good, D-poor

DATE-(UTC)-TIME	LAT(N)	LON(W)	DEP	MAG	QUAL	COMMENTS
yy/mm/dd hh:mm:ss	deg.	deg.	km	Ml		
99/10/03 10:50:29	46.54N	121.81W	3.7	2.5	AC	28.2 km W of Goat Rocks
99/11/16 20:51:16	47.86N	122.00W	19.7	2.5	BA	2.7 km WNW of Monroe, WA
99/11/21 11:33:45	45.46N	122.07W	13.6	2.6	BA	31.3 km WNW of Mount Hood, OR
99/11/25 14:46:15	45.11N	122.78W	28.3	3.4	CB	6.5 km ESE of Woodburn, OR
99/11/29 04:04:15	42.31N	122.01W	7.0	3.4	CB	22.2 km WNW of Klamath Falls, OR
99/12/11 12:53:40	48.53N	123.24W	49.2	3.7	CC	14.4 km NNE of Victoria, BC

00/01/16 15:07:58	47.80N 122.74W	17.6	3.0	AA	11.1 km	NW of
Poulsbo, WA						
00/01/30 19:10:23	45.19N 120.12W	0.0	4.1	CC	6.5 km	SE of
Condon, OR						
00/01/30 20:46:06	45.18N 120.10W	0.0	3.4	BC	8.8 km	SE of
Condon, OR						
00/01/30 20:52:28	45.18N 120.10W	1.8	2.8	CC	8.5 km	SE of
Condon, OR						
00/01/31 03:48:29	48.30N 121.62W	4.1	1.2	BC	5.9 km	NNW of
Darrington, WA						
00/02/01 09:25:36	45.18N 120.11W	0.0	2.8	CC	7.7 km	SE of
Condon, OR						
00/02/29 18:36:37	45.18N 120.11W	0.0	2.5	BC	7.4 km	SE of
Condon, OR						
00/04/11 09:09:03	48.40N 122.27W	14.4	3.2	BA	5.2 km	ESE of
Mount Vernon, WA						
00/04/22 06:43:25	46.86N 121.97W	8.8	3.6	AB	16.5 km	W of
Mount Rainier						
00/06/29 19:27:26	48.46N 123.10W	27.6	3.5	BC	10.6 km	SW of
Friday Harbor, WA						
00/09/10 14:53:38	48.42N 123.19W	49.3	3.2	BC	11.6 km	E of
Victoria, BC						

Publications

Quarterly bulletins from the PNSN provide operational details and descriptions of seismic activity in Washington and Oregon. These are available from 1984 through the third quarter of 2000. PNSN Quarterly Reports from 1994-1998 included moment-tensor focal mechanisms for earthquakes larger than magnitude 3.5 provided by Dr. John Nabelek of Oregon State University ([OSU](#)) under support from USGS NEHRP Grant 1434-93-G-2326. Final published catalogs are available from 1970, when the network began operation, though 1989. A 1990-1994 printed catalog is in preparation.

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