QUARTERLY NETWORK REPORT 2005-A

on

Seismicity of Washington and Oregon

January 1 through March 31, 2005

Pacific Northwest Seismograph Network

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This report is prepared as a preliminary description of the seismic activity in Washington State and Oregon. Information contained in this report should be considered preliminary and not cited for publication without checking directly with network staff. The views and conclusions contained in this document should not be interpreted as necessarily representing the official policies, either express or implied, of the U.S. Government**.**

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INTRODUCTION

This is the first quarterly report of 2005 from the Pacific Northwest Seismograph Network (PNSN), at the University of Washington Dept. of Earth and Space Sciences, covering seismicity of Washington and western Oregon.

Comprehensive quarterlies have been produced by the PNSN since the beginning of 1984. Prior to that we published quarterly reports for western Washington in 1983 and for eastern Washington from 1975 to 1983. Annual technical reports covering seismicity in Washington since 1969 are available from the U.W. Dept. of Earth and Space Sciences. The complete PNSN earthquake catalog is available on-line, both through our web-site and through the ANSS earthquake catalog. In these reports we provide special coverage (figures, counts, listings, etc.) of earthquake swarms, aftershock sequences, etc.

This quarterly report discusses network operations, seismicity of the region, unusual events or findings, and our educational and outreach activities. This report is preliminary, and subject to revision. The PNSN routinely records signals from selected stations in adjoining networks. This improves our ability to locate earthquakes at the edges of our network. However, our earthquake locations may be revised if new data become available. Findings mentioned in these quarterly reports should not be cited for publication.

Prior to 2004, each quarterly included station tables and maps. Beginning in 2004, station tables and maps will be included only in the 4th quarter report. Lists of currently operating stations are available on-line through web page http://www.pnsn.org/OPS/stations.html.

NETWORK OPERATIONS

Lists of currently operating stations are available on-line through web page http://www.pnsn.org/OPS/stations.html. Table 1 gives approximate periods of time when individual stations were inoperable. Data for Table 1 are compiled from weekly plots of network-wide teleseismic arrivals and automated and manual digital and analog signal checks, plus records of maintenance and repair visits.

TABLE 1 - Station outages and installations

Station	Outage Dates	Comment
AHAB	02/08/05	Installed on growing dome – Mt. St. Helens
AHAB	02/16/05	Removed; replaced by MIDE
ALVY	01/23/05-03/08/05	Dead
ATES	02/25/05-03/01/05	No communications
BHW	03/14/04-End	Very noisy
BLIS	02/12/05	Dead; power failure
BRKS	12/23/04-01/03/05	No communications
BULL	03/28/05-End	Dead
BURN	11/23/04-02/20/05	Dead
ERW	12/13/04-01/08/05	No communications
FL2	11/28/04-End	Dead
GHW	12/23/04-02/02/05	Noisy
GL2	10/21/04-End	Dead
GLK	11/26/04-End	Noisy
GNW	01/01/05-End	Noisy
GPW	03/16/04-End	Dead
HART	02/09/05	Installed
HART	02/09/05-02/21/05	No communications
HDW	12/28/04-End	Dead
JBO	10/15/04-End	Noisy
KEEL	08/18/04-12/01/04	No communications
LYNC	02/08/05	Installed
MBKE	11/18/04-01/05/05	K2 removed for repair
MBW	12/07/04-End	Dead; shut down relay site due to radio interference
MCW	12/07/04-End	Dead. bad seismometer
MIDE	02/16/05	Installed – Mt. St. Helens
MIDE	03/08/05	Destroyed by Mt. St. Helens eruption
MIDE	04/14/05	Re-installed – Mt. St. Helens

TABLE 1 - Station outages and installations

Station	Outage Dates	Comment
NED	03/08/05	Destroyed by Mt. St. Helens eruption
NED	04/06/05	Re-installed – Mt. St. Helens
NLO	08/20/04-09/11/04	Dead; aircells died
OBH	01/31/02-End	Temp. removed for logging
ON2	03/01/05-End	Noisy
OOW	01/13/05-02/14/05	Dead
OSD	01/13/05-02/14/05	Dead because it transmits through OOW
OSR	01/22/05-02/09/05	Dead
OSR	03/01/05-End	Dead
PAYL	12/13/04-01/12/05	Intermittent communications
PCMD	01/18/05-03/10/05	Dead; water in vault
PERL	01/29/05-End	No communications
PGW	10/08/03-End	Dead
RCS	12/25/04-01/27/05	Noisy
RER	10/20/04-End	Noisy
RMW	12/07/04-End	Dead
RVC	12/05/03-End	Noisy
RVW	02/23/05-End	Dead
SAW	01/08/05-02/01/05	Noisy
SEA.HH?	12/05/03-End	Disconnected for renovation
SEP	03/08/05	Destroyed by Mt. St. Helens eruption
SEP	03/15/05	Re-installed – Mt. St. Helens
SFER	09/01/04-End	Short period dead; needs removal
SHIP	11/05/04-End	Removed due to building demolition
SLF	01/06/05-01/22/05	Dead
SMW	06/20/03-End	Intermittent
SOPS	08/27/02-End	K2 flash problem
SSS1	9/23/04-01/01/05	Communication intermittent
SSS1	03/05/05-End	Dead
SSS2	10/25/04-01/01/05	Communication intermittent
SSO	08/28/04-End	Intermittent
SUG	03/09/05	Installed – Mt. St. Helens
SVOH	12/30/04-01/10/05	No communications
TDL	11/28/04-End	Dead
TOLO	10/15/04-End	No communications
TRW	01/09/05-01/22/05	Dead
TTW	01/01/05-End	Noisy
VBE	02/17/05-End	Intermittent; usually very noisy
VGB	09/23/04-End	Intermittent; usually very noisy
WA2	01/05/05-02/02/05	Dead
WA2	02/08/05-02/17/05	Dead
WPW	05/02/04-01/06/05	Intermittent
WWHS	02/22/05-03/03/05	No communications
YA2	01/17/05-02/18/05	Dead

Mt. St. Helens eruption, 2004-2005

Beginning on September 23, 2004 a series of small earthquakes at Mount St. Helens signaled the beginning of the first dome-building eruption at the volcano since 1986. The small earthquakes soon escalated into the most vigorous seismic activity at Mount St. Helens since the catastrophic eruption of 1980. Continuous seismic data from short-period stations near Mt. St. Helens are archived at the PNSN and streamed to the IRIS BUD archive. New procedures were implemented to rapidly handle the large volume of data so the PNSN and Cascade Volcanoes Observatory could assess the significance of the rapidly changing seismicity.

Equipment; gain changes, destruction, replacement, and new installations

Station BLIS died from a power failure on February 12; it was most likely buried by the portion of the dome known as the "whaleback", a mound of new magma that increased in size over the quarter. Station AHAB was installed (EHZ and ELZ components) on the whaleback February 8. Because of its location on the unstable magma dome AHAB wasn't expected to survive long, so with new radios and batteries, it was moved on February 16 and became station MIDE. Station MIDE was installed near the site of old station BLIS.

Stations SEP, MIDE, and NED were destroyed during the ash and steam eruption of March 8. SEP was replaced on March 15. Station NED was reinstalled on April 6 and station MIDE was reinstalled on April 14. New station SUG (EHZ component) was installed on March 9 near the crater at Sugar Bowl.

Gain changes were made at station YEL (turned down 6 db on March 16). The gain change was made to improve the usefulness of this station. The volcano signals were nearly continuous and energetic enough to saturate the station at its previous gain.

24 Hour Volcano Watch and pager alert changes

Throughout the quarter, scientists at the PNSN and CVO shared 24-hour volcano watch duties. During the night, scientists would check seismic monitors, webcams and debris flow monitors every 2 hours for unusual activity.

Daytime (7 AM – 11 PM) pager triggering for Mt. St. Helens earthquakes had to be desensitized. Normal procedure for daytime pages has been to page for events larger than magnitude 1.5. In late September, daytime pages from Mt. St. Helens began to occur continuously. Therefore, the daytime paging script was modified in early October to page only on Mt. St. Helens events having preliminary magnitudes of 2.0 or greater and having 8 or more stations in a triggered state. The daytime paging threshold has been adjusted over the course of the sequence to page on events of higher-than-average magnitude. Alert event pages, normally for earthquakes larger than 2.8, were adjusted to exclude St. Helens events from early Oct. to early November.

Rapid automatic analysis of earthquake data

Our traditional method of analyzing earthquake data in the Pacific Northwest, i.e. using a triggering algorithm to detect earthquakes and manually processing every earthquake, quickly became unmanageable. To get rapid information on the ongoing sequence, we implemented automatic analysis of selected channels of continuously recorded seismic data. Near-real-time results of these analyses are being updated every 30 minutes at http://www.pnsn.org/WEBICORDER/RMS/

One of the most useful parameters we compute is a Real Time Seismic Amplitude Monitor (RSAM). RSAM is the root mean square (RMS) amplitude of ground motion at a station averaged over a time period. We have found averaging times of 10 minutes and 1 minute to be useful. It is necessary to monitor the RSAM at several stations because the data at close stations may be clipped. The RSAM provides an important parameter to consider in determining the hazard alert level at the volcano.

In addition to the RSAM we implemented an event detection algorithm to automatically determine earthquake times from the continuous seismic data. For each earthquake detected we determine the (trigger) time, duration of the signal, maximum amplitude, maximum RMS amplitude, and the frequency of the maximum spectral amplitude. Using this automated procedure on the continuous data from station YEL, we detected about 500,000earthquakes of magnitude 0.1 or greater from the beginning of the seismic activity (September 23, 2004) through the first quarter of 2005; with about 70,000 earthquakes occurring in the first quarter of 2005.

Standard analysis of earthquake data

On November 20, 2004 we desensitized the triggering at Mount St. Helens stations so that only the largest earthquakes are recorded automatically. All non-Mount St. Helens events still produced triggers. To capture significant events at Mount St. Helens, we reviewed continuous data from stations near the mountain, and retrieved data in selected time windows containing especially interesting events and a sample of the seismicity (usually only a few events/hr.), particularly events with large amplitude, impulsive arrivals, or unusual depth, frequency, location , or signal characteristics. These events are processed in the traditional way, i.e. determine a hypocenter, magnitude, and fault plane solution if possible. Less than 1 percent of the detected events were processed in this way and we tended to favor processing of the larger events.

Disk Space

This sequence required emergency acquisition of additional disk space. See last quarter's report for details.

Strong Motion Instrumentation Update

The final Duwamish Valley array station was installed on March 2 of this quarter. Station HART is co-located with USGS Seattle Urban Hazards Array station HAR on Harbor Island. The station location had been identified for over a year but

finding a suitable means of telemetry required additional time. Data from HART are sent via wireless radio to the roof of Harborview Medical Center, and from there are sent via the Internet using TCP/IP. Harborview is part of University of Washington, so the IP permitting was straightforward. The wireless telemetry for HART and GTWN continue to operate in a satisfactory manner despite radio interference.

An additional ANSS station was installed in south Snohomish County. Station LYNC was installed in the Lynnwood City Hall on February 9. This is a reference site installation with TCP/IP telemetry. This location fills in a gap in coverage for the area between Seattle and Everett.

Computer Hardware Update

Scossa continues to be our main data collection computer, and *tremito* provides additional computational power for manual processing of earthquake data and acts as a fileserver for all the other networked computers in the group.

Automatically generated Web-pages: Webicorder Update

Currently 100 PNSN stations are available on webicorders through six index pages. Webicorders indexes are grouped by type (short-period, broad-band, and strong motion), plus a special index for stations located on volcanoes.

Use of PNSN Data

The IRIS Data Management Center reports 185 requests for PNSN trace-data this quarter. Nearly 3,500,000 traces were requested. This represents at least an order of magnitude increase in the number of traces requested compared to a "typical" quarter.

EARTHQUAKE DATA – 2005-A

Between January 1 and March 31, 2005, 3,027 events were digitally recorded and processed at the University of Washington. Thousands of additional unlocated events occurred at Mount St. Helens associated with the dome-building eruption which began in late September 2004. Locations in Washington, Oregon, or southernmost British Columbia were determined for 2,529 of these events; 2,442 were classified as earthquakes and 87 as known or suspected blasts. The remaining processed events include teleseisms (159 events), regional events outside the PNSN (70), and unlocated events within the PNSN, mostly at Mt. St. Helens. Due to the overwhelmingly large number of events, event triggering was used only for quakes larger than about 2.0. Additional individual event files were created manually for a representative sampling of Mount St. Helens seismicity to be located and cataloged. Continuous data from Mt. St. Helens stations are available from the IRIS DMC. Other unlocated events within the PNSN normally include surficial events on Mt. St. Helens and Mt. Rainier quakes, and blasts. Frequent mining blasts occur near Centralia, Washington and we routinely locate them.

Table 2 lists earthquakes reported to have been felt during this quarter. Events with ShakeMaps or Community Internet Intensity Maps (CIIM) are indicated. This quarter, all three felt events generated both ShakeMaps and "CIIM" maps (**http://pasadena.wr.usgs.gov/shake/pnw/**), which convert "felt" reports sent by the general public (via Internet) into numeric intensity values. CIIM maps show the average intensity by zip code.

Table 3 is this quarter's catalog of earthquakes M 2.0 or greater, located within the network - between 42-49.5 degrees north latitude and 117-125.3 degrees west longitude.

Figure 1. Earthquakes with magnitude greater than or equal to 0.0 (M_c >=0).

Figure 2. Blasts and probable blasts (M_c >=0).

Figure 3. Earthquakes located near Mt. St. Helens (M_c >=0).

Figure 4. Earthquakes located near Mt. Rainier (M_c >=0).

TABLE 2 - Felt Earthquakes during the 1st Quarter of 2005

DATE-(UTC)-TIME	LAT(N)	LON(W)	DEP	MAG	COMMENTS	CIIM	ShakeMap
yy/mm/dd hh:mm:ss	deg.	deg.	km	Ml			
05/02/03 14:08:04	48.08	122.57	32.2	3.1	30.4 km WNW of Everett, WA	✔	✔
05/03/06 13:20:06	48.02	121.83	13.6	3.5	12.2 km SE of Granite Falls, WA	✔	✔
05/03/13 03:37:47	47.25	122.82	24.1	3.3	23.8 km NNE of Olympia, WA	✔	✔

OREGON

During the first quarter of 2005, 65 earthquakes were located in Oregon between 42.0 degrees and 45.5 degrees north latitude, and between 117 degrees and 125 degrees west longitude. The most notable earthquake in Oregon this quarter was a very shallow M 2.6 event on Jan. 26 near Lakeview, Oregon, near the California border, where swarm activity occurred last year. The PNSN located only 3 quakes in the Lakeview area this quarter.

WESTERN WASHINGTON SEISMICITY

During the first quarter of 2005, 2,317 earthquakes were located between 45.5 degrees and 49.5 degrees north latitude and between 121.0 degrees and 125.3 degrees west longitude. Most western Washington seismicity this quarter was in the Mount St. Helens area, see discussion below. Three earthquakes were felt this quarter in western Washington.

Excluding Mt. St. Helens, the largest earthquake in western Washington this quarter was a magnitude 3.5 event on March 6 (UTC), located about 12 km south-east of Granite Falls at a depth of about 14 km. The deepest earthquake in western Washington this quarter was a magnitude 1.1 event at about 60 km depth located about 9 km west-southwest of Everett, WA on March 5 (UTC).

WASHINGTON CASCADE VOLCANOES

Mount St. Helens

Mount St. Helens seismicity and dome building eruption continued through this quarter. The eruptive episode began with a vigorous sequence of seismic activity starting on September 23, 2004. Activity accelerated into early October. The most energetic seismicity occurred on Oct. 1-5 when several phreatic explosions and half-hour to hour-long periods of harmonic tremor interrupted and temporarily calmed extremely high rates of magnitude 3+ seismicity. Seismicity fell following after Oct. 5, though frequent, but smaller earthquakes have continued through this quarter. Because of the high rates of seismicity, only a representative sample of Mount St. Helens events was located using conventional manual processing. Figure 3 shows located volcano-tectonic earthquakes near Mount St. Helens. Low frequency (L) and avalanche or rockfall events (S) are not shown. Seismograph stations operating during the fourth quarter are shown in the Appendix. See the operations section for details on destruction, replacement and new instrument installation during the first quarter.

An estimate of Mount St. Helens seismicity using automated counting procedures and data from station YEL suggests that about 70,000 earthquakes magnitude 0.1 or larger occurred at Mount St. Helens during the 1st quarter of 2005. Although in seismically quiet times our catalog of events at Mount St. Helens is complete to about magnitude 0.0, only a small subset of this quarter's activity was processed using our normal procedure. This quarter, 2,099 earthquakes were located in the area shown in Fig. 3 using conventional manual processing procedures (including 1,914 earthquakes between magnitude 1.0 and 2.9, and 7 slightly larger events with magnitudes between 3.0 and 3.2). All locatable earthquakes in the 2004/2005 sequence are relatively shallow. No events occurred at depths exceeding 2 km. The vigorous seismicity last quarter, and the tectonic events this quarter tended to be located on the boundary between the old and new domes near the vent that first appeared in early October, 2004. This quarter we recorded some large rockfalls off the new dome. Rockfalls that occurred during clear weather exposed glowing hot rocks in the core of the whaleback, and flashes of light were recorded simultaneously with rockfall signals at 04:38 UTC Jan. 14, 7:00 UTC Jan 15, and 9:11 UTC Feb. 7. An eruption at 01:25 UTC on March 9 (afternoon of March 8, local time) sent an ash plume to 36,000 feet elevation. Darryl Luscombe has been compiling and digitally enhancing nighttime volcano-cam images (http://www.luscombe-carter.com/mount_st_helens/index.html) that show variations in the amount of light shining forth from the new dome. At times a steady glow is visible, while sudden brief bursts of light (likely rockfalls) are seen at other times. Volcano-Tectonic earthquakes continue to occur with a somewhat regular inter-occurrence time which has varied slowly over days and weeks.

The USGS has issued an information sheet summarizing the 2004-2005 eruption through March 31, 2005.
http://vulcan.wr.usgs.gov/Volcanoes/MSH/Publications/FS2005-3036/FS2005-3036.html

Mount Rainier

The number of events in close proximity to the cone of Mt. Rainier varies over the course of the year, since the source of much of the shallow activity is presumably ice movement or avalanching at the surface, which is seasonal in nature. Events with very low frequency signals (1-3 Hz) believed to be icequakes are assigned type "L" in the catalog. Emergent, very long duration signals, probably due to rockfalls or avalanches, are assigned type "S" (see Key to Earthquake Catalog). Three events flagged "L" or "S" were located at Mount Rainier this quarter and 172 "L" or "S" events were recorded, but were too small or too emergent to locate reliably. Type L and S events are not shown in Fig. 4.

A total of 56 tectonic events (18 of these were smaller than magnitude 0.0, and thus are not shown in Fig. 4) were located within the region shown in Fig. 4. The largest tectonic earthquake located near Mt. Rainier this quarter was a magnitude 2.1

event on Jan. 20 (UTC), located about 15 km west-northwest of the mountain at about 9 km depth. This quarter, 33 tectonic earthquakes were located in the "Western Rainier Seismic Zone" (WRSZ), a north-south trending lineation of seismicity approximately 15 km west of the summit of Mt. Rainier (for counting purposes, the western zone is defined as 46.6-47.0 degrees north latitude and 121.83-122 west longitude). Within 5 km of the summit, there were 11 (3 of them smaller than magnitude 0.0 and thus not shown in Fig. 4) higher-frequency tectonic-style earthquakes, and the remaining events were scattered around the cone of Rainier as shown in Fig. 4.

EASTERN WASHINGTON SEISMICITY

During the first quarter of 2005, 69 earthquakes were located in eastern Washington in the area between 45.5 - 49.5 degrees north latitude and 117 - 121 degrees west longitude. The largest earthquake recorded in eastern Washington this quarter was a magnitude 2.6 event on Feb. 25 (UTC). It occurred at about 2 km depth, and was located about 36 km west-northwest-of Yakima.

OTHER SOURCES OF EARTHQUAKE INFORMATION

We provide automatic computer-generated alert messages about significant Washington and Oregon earthquakes by e-mail, FAX or via the pager-based RACE system to institutions needing such information, and we regularly exchange phase data via e-mail with other regional seismograph network operators.

Other regional agencies provide earthquake information. These include the Geological Survey of Canada (Pacific Geoscience Centre), Sidney, B.C. **http://www.pgc.nrcan.gc.ca/seismo/table.htm** ; and other regional networks in the United States **http://earthquake.usgs.gov/regional/** The US Geological Survey coordinates earthquake information nationally; **http://earthquake.usgs.gov**.

Complete catalog listings are available on-line through **http://www.pnsn.org/CATDAT/catalog.html** Key to earthquake catalog can be found in the last quarterly report of each year, or at:
http://www.pnsn.org/INFO_GENERAL/PNSN_QUARTERLY_EQ_CATALOG_KEY.htm

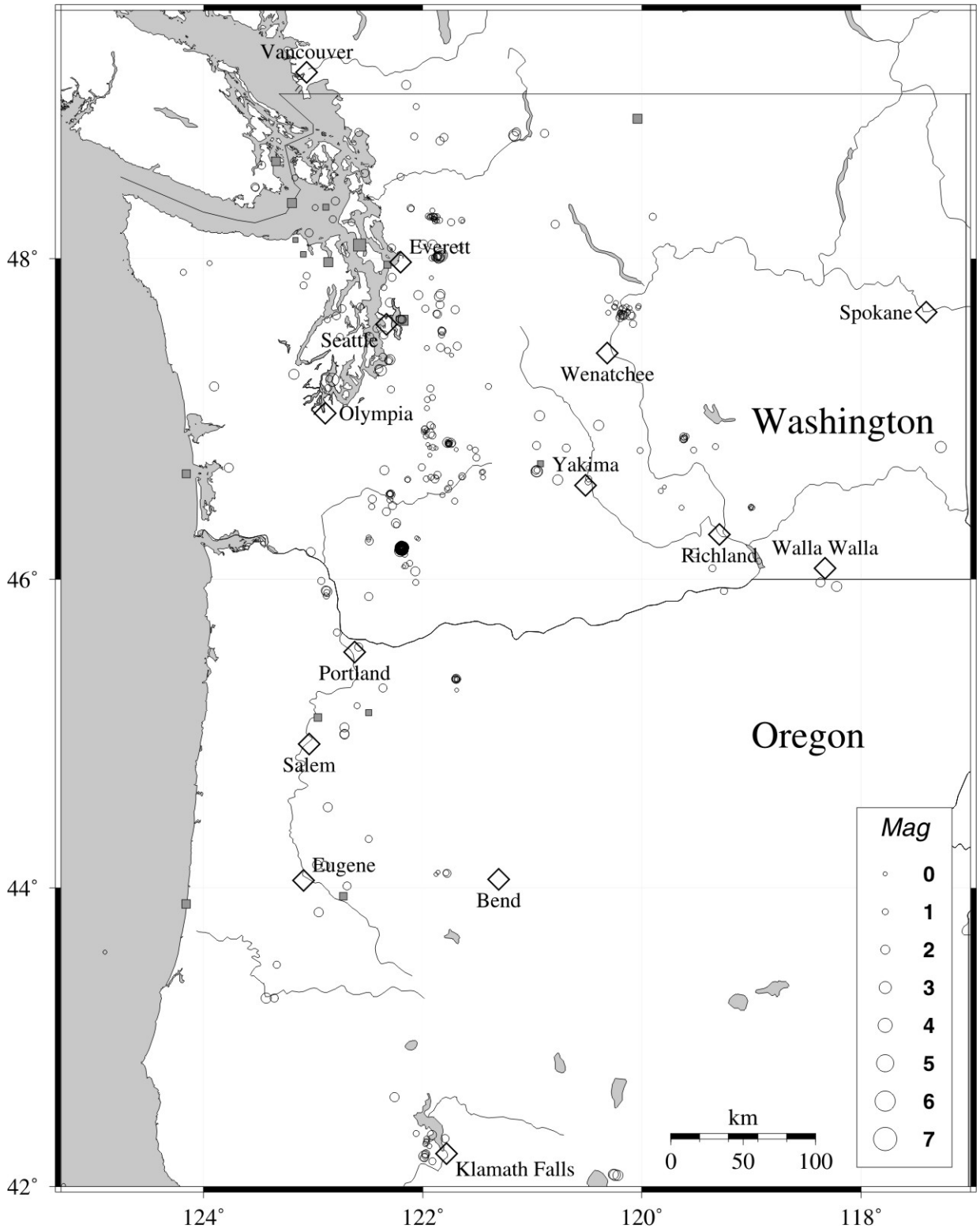

Figure 1 Earthquakes with magnitude greater than or equal to 0.0 (Mc>=0.0). Unfilled diamonds represent cities. Quakes shallower than 30 km are indicated by circles, and deeper quakes by filled squares.

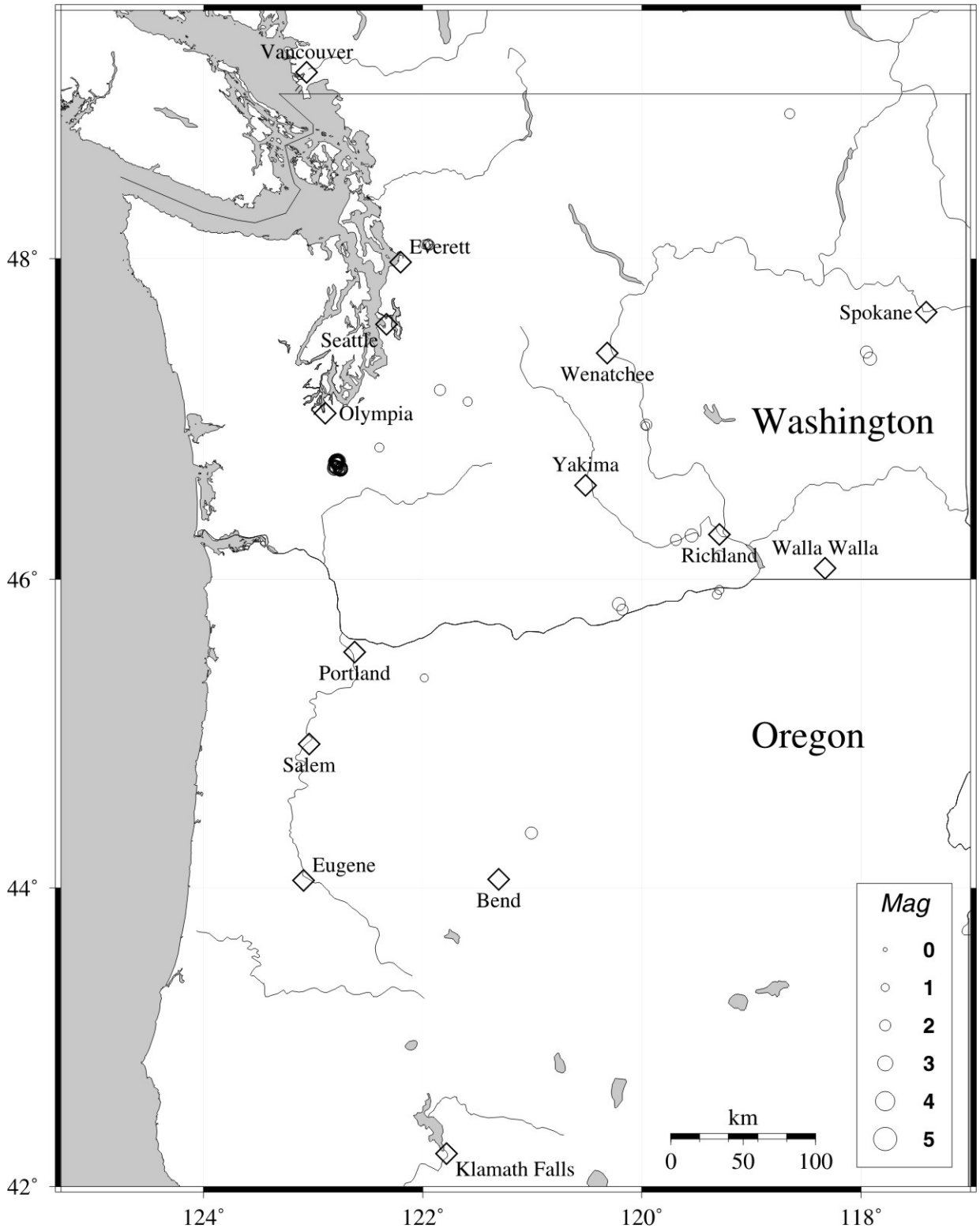

Figure 2. Blasts and probable blasts. Unfilled diamonds represent cities.

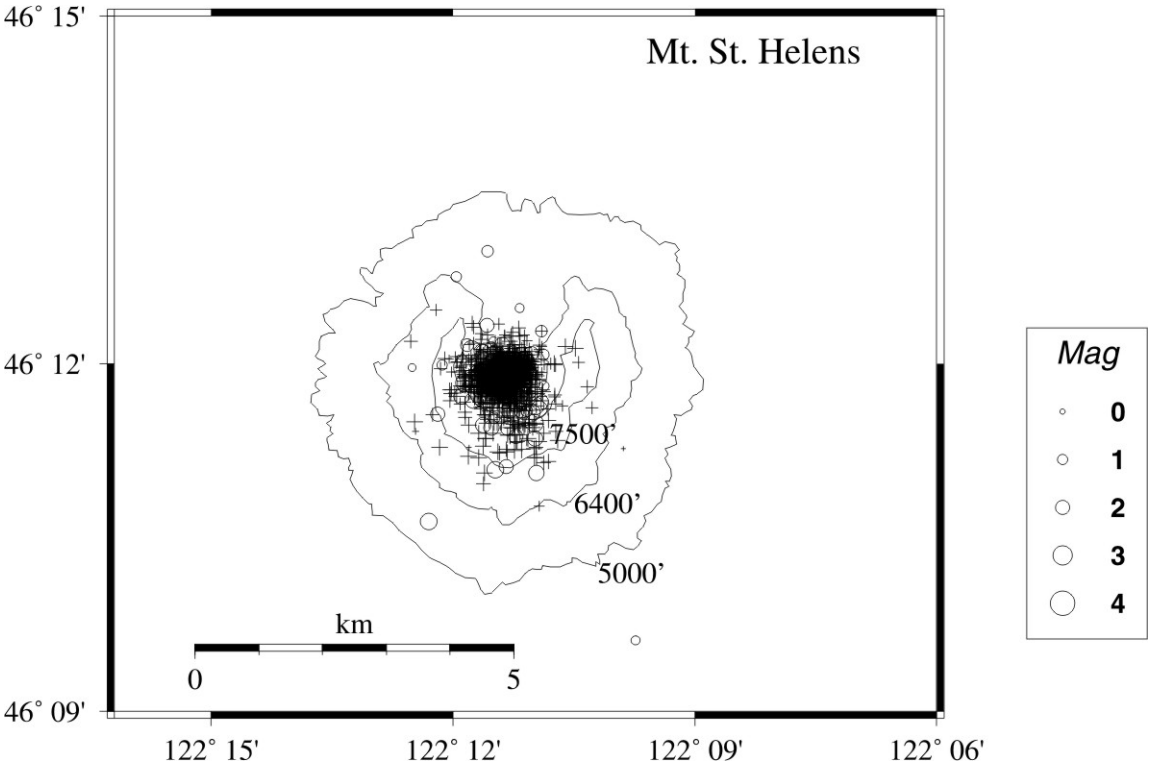

Figure 3. Earthquakes at St Helens, M>0.0.

Events elected by the analyst for location are small fraction of the number of events recorded during the quarter.
Plus symbols indicate depth less than 1 km. Circles indicate depth greater than 1 km. Elevation contours shown in feet.

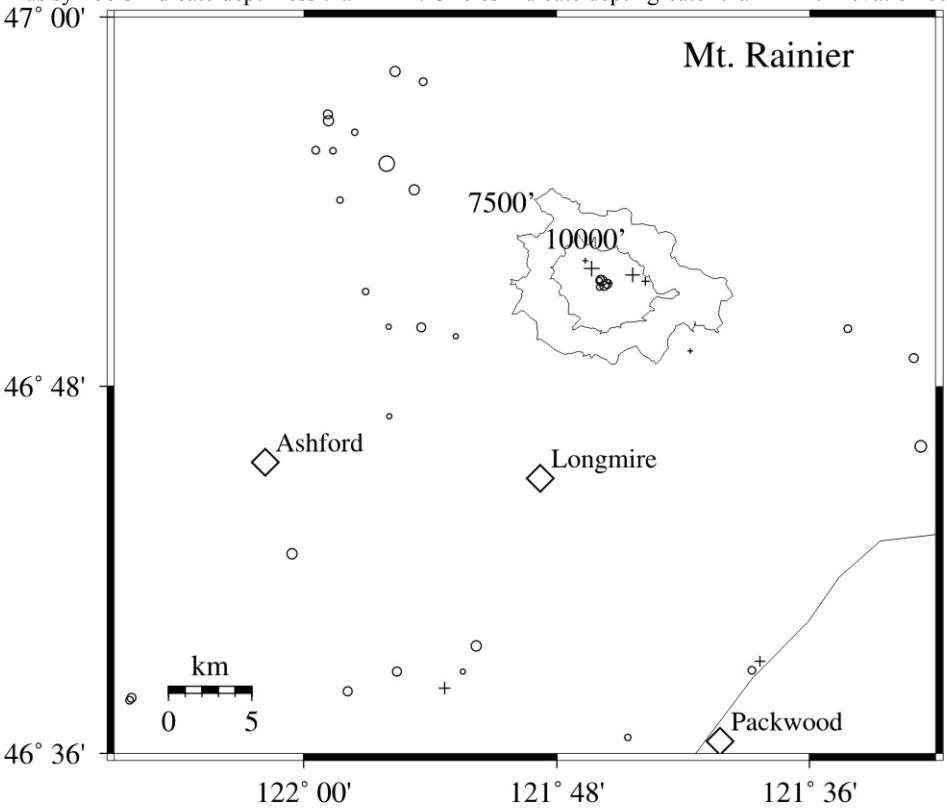

Figure 4. Earthquakes at Mt. Rainier, M>0.0.

EARTHQUAKE CATALOG, 2005-A

This quarter's catalog lists earthquakes of magnitude 2.0 or larger, except at Mt. St. Helens, where only events of magnitude 3.0 or larger are shown. Complete catalog listings are available on-line through **http://www.pnsn.org/CATDAT/catalog.html**
Key to earthquake catalog can be found in the last quarterly report of each year, or at:
http://www.pnsn.org/INFO_GENERAL/PNSN_QUARTERLY_EQ_CATALOG_KEY.htm

Jan 2005

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
13	05:15:27.44	44 08.67	122 53.28	3.90	2.1	21/024	57	0.34	CC	O0	
15	00:44:35.48	42 36.38	122 15.42	22.06*	2.1	4/004	243	0.01	AD	K3	
19	01:27:27.99	47 46.04	121 50.65	0.40	2.4	41/042	36	0.38	CB	P3	
20	05:23:30.17	46 55.23	121 56.06	8.59	2.1	36/037	33	0.28	BC	C3	
24	13:20:20.55	42 04.80	120 14.83	0.02*	2.6	10/010	148	0.19	BD	K3	

Feb 2005

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
2	22:31:52.77	47 37.35	122 10.70	30.13	2.3	53/054	34	0.33	CA	P3	
2	23:10:40.28	43 16.21	123 25.80	6.17$	2.4	8/008	257	0.18	CD	O0	
3	00:19:10.94	45 00.36	122 42.78	13.44	2.1	8/008	152	0.05	AC	O0	
3	09:06:02.58	48 00.52	121 51.09	17.11	2.3	39/040	59	0.53	DB	P3	
3	14:08:04.23	48 05.02	122 34.56	32.16	3.1	76/089	55	0.36	CA	P3	F
4	19:30:05.83	47 18.76	122 22.90	27.54	2.5	60/061	67	0.24	BA	P3	
6	03:14:51.02	47 39.36	120 06.81	0.70	2.3	24/025	80	0.32	CC	N3	
6	04:01:19.66	46 42.20	123 46.13	20.04*	2.0	22/022	167	0.18	BC	P3	
6	04:33:45.49	42 04.50	120 12.98	5.34	2.3	10/010	127	0.36	CC	K3	
6	08:53:53.48	48 45.14	121 09.64	0.02*	3.2	26/029	127	0.25	BC	C3	
8	00:15:28.89	44 31.85	122 51.88	0.05*	2.0	13/013	174	0.22	BC	O0	
9	09:58:44.14	45 55.36	122 52.42	17.94#	2.3	36/036	56	0.17	BB	C3	
9	22:16:48.85	46 58.14	120 23.51	0.47*	2.4	15/015	42	0.26	BC	E3	
11	00:12:13.23	46 50.05	117 16.28	15.16$	2.5	14/014	231	0.71	DD	E3	
12	13:17:13.13	46 12.07	122 11.30	0.03*	2.4	16/016	58	0.19	BA	R0	
19	03:50:10.40	47 47.14	121 50.25	8.65	2.1	18/018	77	0.2	BA	P3	
19	13:01:52.72	45 02.88	122 42.72	7.56	2.0	4/004	179	0.45	DD	O0	
20	03:39:33.70	46 40.97	120 57.51	1.46$	2.5	41/043	76	0.34	CC	C3	
21	12:01:08.51	48 00.69	121 52.52	10.37	2.1	18/020	93	0.27	BC	P3	
23	21:45:29.43	47 22.64	122 17.86	22.31	2.2	55/056	39	0.34	CA	P3	
24	05:55:54.08	46 11.52	122 11.54	0.19	2.8	11/011	165	0.07	AC	SD	
25	23:21:12.68	46 40.99	120 57.55	1.59$	2.6	51/052	28	0.32	CC	C3	
26	03:35:39.92	48 51.02	120 02.23	32.22	2.0	6/006	318	0.3	DD	N3	
26	20:56:45.03	44 09.13	122 57.69	0.26	2.1	7/007	220	0.14	BD	O0	
27	08:47:54.16	47 17.27	123 10.42	18.62	2.3	32/033	50	0.18	BA	P3	

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DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
1	20:26:15.34	46 37.60	120 46.12	0.03*	2.2	12/013	185	0.28	BD	C3	
2	22:18:12.38	48 01.11	121 50.02	13.15	2.2	30/031	60	0.49	CB	P3	
4	13:51:14.49	42 12.39	121 59.26	3.74	2.4	15/016	77	0.25	BB	K3	
5	11:42:46.65	46 11.77	122 11.40	0.59	3.0	18/018	50	0.09	AA	S4	
6	11:36:02.24	48 00.46	121 51.31	13.06#	2.7	22/023	59	0.38	CB	P3	
6	13:20:06.43	48 01.30	121 50.00	13.57	3.5	93/093	60	0.5	DB	P3	F
9	17:28:21.72	47 58.90	122 51.48	54.13	2.0	24/024	63	0.16	BA	P3	

9	22:27:48.26	45 57.13	118 13.21	0.02*	2.2	13/013	192	0.46	CD	E3	
11	01:22:15.29	42 04.92	120 15.54	0.02*	2.2	9/009	139	0.26	BD	K3	
13	03:37:47.71	47 15.26	122 49.49	24.11*	3.3	83/083	40	0.31	CA	P3	F
18	20:01:51.64	43 50.38	122 56.90	17.99	2.0	6/006	245	0.24	CD	O0	
18	21:12:14.67	45 00.18	122 42.74	11.67	2.0	5/005	157	0.05	AD	O0	
26	14:15:20.39	46 11.58	122 11.25	0.63	3.1	29/029	45	0.34	CA	S4	
27	01:28:54.24	46 11.71	122 11.39	0.35	3.2	29/029	43	0.19	BA	S4	
27	04:31:14.36	46 11.65	122 11.38	0.05*	3.0	33/033	43	0.44	CA	S4	
27	11:46:03.38	46 11.68	122 11.43	0.66	3.0	32/032	43	0.37	CA	S4	
27	17:26:13.85	46 11.39	122 11.28	0.97	3.0	23/024	46	0.15	BA	S4	
30	12:33:41.15	47 01.82	120 55.95	3.51	2.4	47/049	51	0.21	BC	C3	
31	01:46:34.75	46 11.68	122 11.12	0.04*	3.1	24/024	43	0.25	BA	S4	

OUTREACH ACTIVITIES

The PNSN staff and faculty participate in an educational outreach program designed to better inform the public, educators, businesses, policy makers, government agencies, engineers, and the emergency management community about earthquake, volcano and related hazards. Our program offers lectures, classes, lab tours, workshops, consultations, and electronic and printed information products. Special attention is paid to the information needs of the media. We provide information directly to the public through information sheets, an audio library, email, and via the Internet at http://www.pnsn.org.

Audio Library, Phone

The Seismology Lab responded to over 100 calls from the general public, Emergency Managers and government agencies, and another 100 calls from the Media. In addition, the PNSN audio library system received 375 calls this quarter. The audio library provides several recordings. We have a regularly updated message concerning current seismic activity, and there are also recordings describing seismic hazards in Washington and Oregon and earthquake prediction. Callers to the audio library have the option of being transferred to the Seismology Lab for additional information.

Internet outreach: www.pnsn.org

The URL www.pnsn.org was moved to a University server in Sept. 2004 when the Dept. of Earth and Space Sciences (ESS) server was overwhelmed with traffic due to the eruption of Mt. St. Helen. The University server handled extremely high volumes of traffic during the fourth quarter of 2004, providing about 12 million pages to clients. However, the ESS server also provides another popular web site, **Tsunami!**, and internet traffic following the Dec. 26th Sumatra & Andaman Islands earthquake and tsunami again overwhelmed the ESS departmental server. Millions of "Tsunami!" pages were served in January '05, though many hours of intervention were required to keep the server up and running.

Tsunami!, hosted by ESS since 1995, was the #1 tsunami link on Google and other popular search engines, but was somewhat out of date. PNSN staff joined a committee to renovate the **Tsunami!** web site led by Dr. Catherine Petroff of UW's Civil Engineering and Professor Jody Bourgeois of ESS. Mike Brown, the chair of the Dept. of Earth and Space Sciences, declared PNSN, **Tsunami**!, and the departmental web sites essential departmental services, and ESS developed and signed a memorandum of understanding with the University's Computer & Communications (C&C) unit. C&C will provide dual separated web servers located in different UW Gigabit backbone locations and will implement a round-robin-type dynamic network service (DNS) to these machines with "fail-over" redundancy to maximize availability and reliability. The total cost of these services and necessary hardware is about $3,000 a year, which is being paid by the Dept. of Earth and Space Sciences, a significant new contribution to PNSN operations. PNSN server upgrades are also in the works and full transition to the new system is expected in the summer of 2005.

E-mail Communications

PNSN staff replied to about 360 e-mail messages from the public seeking information on a variety of topics via the ***seis_info@ess.washington.edu*** email address. Ruth Ludwin managed our e-mails this quarter, typically responding to routine questions within a day. Complex or sensitive questions are routed to the appropriate person (PNSN or otherwise) for a more in-depth response. Requests may include complex scientific inquiries, assistance with hazard assessments and legal issues, consultations with government agencies, and support for engineering issues related to strong motion data.

Information Products

CIIM (Community Internet Intensity Maps) and ShakeMaps were generated for several events this quarter. See the "Earthquake Data" section for details.

CISN Display , a product that will first supplement and later replace the CUBE based RACE (Rapid Alert for Cascadia Earthquakes) system, was released in December (Version 1) and distributed to 24 select users including lifeline operators, emergency managers, and large businesses. CISN servers receiving and displaying PNSN recent earthquake data are being tested, and now provide links to the PNSN ShakeMaps, which are automatically generated following significant earthquakes.

The Seattle ShakeMap Working Group, led by Ivan Wong, convened at UW and finalized details for a proposal to FEMA to build high-resolution ShakeMaps in the greater Seattle area, and to push data to FEMA, WSEMD, Seattle EM to aid in response and to improve loss estimation.

K-20 Education Outreach: http://www.pnsn.org/EDHOME/index.html

PNSN and USGS staff gave 25 Seismology Lab tours and presentations for K-12 students and teachers, serving about 625 students this quarter.. This included a series of tours for participants in "Math Day" at the UW, a function attended by hundreds of math-aware high school students from all over Washington State. The PNSN maintains an email list-service of over 50 local K-20 educators and subscribers interested in earth-sciences education, and occasionally send out messages on events of special interest.

The PNSN provided 5 tours for college students, including groups from Western Washington University, The Seattle Arts Institute, and prospective graduate students of the UW Dept. of Earth and Space Sciences.

Media Relations:

The PNSN staff frequently provides interviews, research support, and referrals to radio, television, film, and print media. The PNSN organizes press conferences, contributes to TV and radio news programs and talk shows, and provides field opportunities linking reporters with working scientists. Staff members also assist news organizations, authors, television producers, and independent documentary makers to design accurate and informative stories and programs related to earthquake and volcano hazards. PNSN staff work to link reporters and producers developing stories with the appropriate research institutions, agencies, and scientists working in the areas to be covered by the piece. The PNSN coordinates the release of information and media relations with the USGS Western Region, the Cascades Volcano Observatory, and the Oregon Department of Geology and Mineral Industries (DOGAMI).

The current eruption of Mount St. Helens (MSH) continued to stimulate media inquiries but at a much reduced level from the last quarter. PNSN staff was called upon to help plan a variety of news stories, documentaries and films related to the December 26th 2004 Banda Aceh Earthquake and Tsunami. Our own Cascadia Subduction Zone was the focus of many of these productions and reports. Films produced by the Discovery Channel, National Geographic, and the BBC were aired on regional television.

Throughout the quarter, PNSN scientists participated in morning science conferences with CVO three times a week to share data and interpretations, and develop "talking points" for use in interviews.

Meetings, Presentations and Visitors:

- The PNSN helped publicize a series of public lectures at the UW on the impacts of the Dec. 26th Earthquake and Tsunami.
- Bill Steele gave talks on "Understanding Mount St. Helens" and "The Faults Beneath our Feet, Uncovering Earthquake hazards in the Puget Sound Region" at a national, 2 day, Disaster Resistant University Symposium at UW in January, sponsored by the US Department of Homeland Security. He also provided a Seismology Lab Tour for participants at the close of the symposium.
- In February, Bill Steele taught a Puget Sound earthquake hazards class at the Whidbey Island Beach Watchers Association annual Sound Waters Conference, and also gave a lunch-time keynote speech to several hundred Whidbey Island residents.
- Chris Newhall and Bill Steele provided separate public talks at the Pacific Science Center IMAX Theater as part of a "Disaster 101" lecture series accompanying the IMAX movie "Natures Fury".
- Tony Qamar gave a talk on Puget Sound Earthquake Hazards to the Public Affairs Forum in Gig Harbor, WA
- In anticipation of the EERI Seattle Fault Scenario and the CREW Cascadia Subduction Zone Scenario, a presentation was made to the Bellevue City Emergency Management Committee on paleoseismological work in the Puget Sound Region.
- PNSN staff and faculty attended the day-long rollout of the EERI Seattle Fault Scenario in Bellevue (on February 28th, the 4th anniversary of the Nisqually Earthquake), and Bill Steele assisted CREW (The Cascadia Region Earthquake Workgroup) with meeting organization and media relations.
- Tony Qamar, Bill Steele, and Craig Weaver attended a meeting of the PNW ANSS Advisory Committee, Structures Sub Committee working to identify regional candidate buildings for structural instrumentation.