QUARTERLY NETWORK REPORT 2004-B

on

Seismicity of Washington and Oregon

April 1 through June 30, 2004

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 second quarterly report of 2004 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 catalog is available on-line, both through our web-site and through the ANSS 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. Beginning in 2004, station tables will be included only in the 4th quarter report. Lists and maps of currently operating stations are available on-line through web page **http://www.pnsn.org/OPS/stations.html**.

NETWORK OPERATIONS

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.

Operations this quarter were affected by a serious malfunction of a RAID disc system maintained by the UW Dept. of Earth and Space Sciences. Although not used for seismic data acquisition or as an internet server, a considerable amount of information was on these discs, including e-mail archives, station maintenance logs, research materials, and other miscellaneous information. The hardware backup to the RAID system had failed not long before the main system failed, and the tape backups available were over a year old. Some information has been retrieved or patched up, but we will likely be feeling the effects of this loss for some time to come. Every effort was made to recover data from the damaged drives, but without success.

Strong Motion Instrumentation Update

The installations in the Duwamish Valley array continued this quarter. Station KCAM is located at the King County Airport. Station ALKI is located at the King County Wastewater Facilities at Alki Point. Both stations were installed in June 2004.

Also, in late June, two stations were installed near Jordan Valley, Oregon to help monitor an earthquake swarm occurring in the area. Station BURN was installed at the ODOT radio facility near Burns, OR. Telemetry is being supplied by ODOT. Station JORV was installed at Jordan Valley High School and telemetered via an IP connection to the internet.

Computer Processing and Analysis Update

Our main operational computers continue with no change from the previous quarter.

Software Update/Product Development

Washington State Department of Transportation has funded a joint PNSN/ UW Civil Engineering proposal to improve ground-motion processing capabilities and develop fast damage estimates that would serve the emergency earthquake information needs of WSDOT. To make rapid notification much more useful for post-earthquake recovery and emergency response, we are working on the following:

- Build the systems needed to provide bridge damage probabilities based on ShakeMap ordinates, the Washington State Bridge Inventory, and WSDOT provided bridge fragility information. Based on probability of damage, a ranked list of bridges has been produced to help prioritize bridge inspections. This code has been written and was tested and verified to work this quarter. The automation was tested and is running.
- We are currently running two parallel versions of ShakeMap, our current version 2.4 and also version 3.0, which includes the bridge damage prediction code.

CREST Instrumentation Update

A replacement site for CREST station RWW has been found at Wishkah Valley School where we can use IP connectivity. Unexpected siting problems involving power were delaying installation, but a temporary new station, WISH, was installed April 2004 in the maintenance facility of the school. Current plans call for a USArray data logger and telemetry to be installed here next quarter.

Use of PNSN Data

The IRIS Data Management Center reports 166 requests for PNSN trace-data this quarter. Nearly 87,000 traces were requested.

TABLE 1 - Station outages and installations

Station	Outage Dates	Comment
ALKI	06/24/04	Installed
ALST	02/02/04-05/05/04	Bad timing
ALST	06/02/04-End	Bad GPS antenna
BEVT	03/02/04-04/05/04	No communications
BEVT	06/07/04-End	No communications
BHW	03/14/04-End	Very noisy
BRO	02/04/03-End	Dead
BULL	05/21/04-End	Intermittent
BURN	06/29/04	Installed
COR	02/16/04-03/13/04	No communications
ERW	06/17/04-End	No communications
EYES	06/26/04-End	No communications, possible firewall issue
GPW	03/16/04-End	Dead
HBO	02/13/04-06/04/04	Very noisy
HDW	12/19/03-04/29/04	Very noisy
HOLY	05/15/04-06/04/04	No communications; restarted DSL modem
IRO	05/28/04-End	Dead
JORV	06/30/04	Installed
KCAM	06/22/04	Installed
KDK	05/12/04-05/25/04	No communications; firewall issue
LTY	04/27/04-06/25/04	No communications
MBW	01/13/04-06/02/04	Dead
MEGW	04/01/03-End	Bad timing
MPL	01/01/04-End	Bad timing; removed for repair 4/16/04
NLO	03/17/04-05/13/04	Dead; bad receiver
OBH	01/31/02-End	Temp. removed for logging
OOW	12/21/03-End	Off at night, okay during daytime
OSD	12/21/03-End	Intermittent because of OOW
OSR	01/06/04-End	VCO may be off-frequency
PCFR	03/28/04-04/16/04	No communications; bad power strip
PCMD	06/19/04-06/30/04	No communications; bad terminal server
PGO	09/21/03-End	Dead
PGW	10/08/03-End	Dead
PSNS	04/23/04-End	No comm.; removed for repair 6/30/04
RCM	01/27/04-End	Dead
RCS	06/22/04-End	Dead
RMW	03/19/04-05/0404	Dead
RVC	12/05/03-End	Noisy
RVW	02/26/04-04/04/04	Dead
RVW	05/01/04-05/028/04	Very noisy
RWW	10/24/02-End	Temporarily removed; reinstalled as WISH
SEA.HH?	12/05/03-End	Disconnected for renovation
SGAR	04/30/04-06/14/04	Intermittent communication; replaced terminal server

TABLE 1 - Station outages and installations

Station	Outage Dates	Comment
SMW	06/20/03-End	Intermittent
SOPS	08/27/02-End	K2 flash problem
SP2	03/04/04-04/23/04	Temporarily removed, reinstalled 04/23/04
SP2	04/23/04-End	No telemetry
SQM	08/01/03-04/12/04	Channel mix-up
SVTR	04/16/04-05/03/04	No communications
TAKO	07/01/03-End	Bad timing
TOLO	02/20/04-03/13/04	No communications
TRW	07/14/02-End	Fire damage repaired, not seismic
VBE	12/02/03-05/28/04	Dead; bad radio transmitter
VIP	12/09/03-05/18/04	Dead; changed aircells
VTH	04/05/04-05/20/04	Dead; seismometer replaced
VVHS	04/05/04-05/10/04	No communications; firewall issue
WISH	04/20/04	Installed (replacement for RWW)
WPW	05/02/04-End	Intermittent
YEL	02/18/04-05/18/04	Dead; power problem
YPT	03/16/04-04/06/04	Dead

EARTHQUAKE DATA - 2004-B

There were 1,144 events digitally recorded and processed at the University of Washington between April 1 and June 30, 2004. Locations in Washington, Oregon, or southernmost British Columbia were determined for 625 of these events; 490 were classified as earthquakes and 135 as known or suspected blasts. The remaining 519 processed events include teleseisms (160 events), regional events outside the PNSN (79), and unlocated events within the PNSN. Unlocated events within the PNSN include surficial events on Mt. St. Helens and Mt. Rainier, very small earthquakes, 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, two events generated ShakeMaps. ShakeMap (**http://www.pnsn.org/shake/index.html**) shows a map of instrumentally measured shaking using data from accelerometers in the network. Peak ground acceleration (PGA) values on the map are modeled from recorded accelerometer data, known local geology, and distance to the epicenter. Another data product "CIIM" maps (**http://pasadena.wr.usgs.gov/shake/pnw/**) convert "felt" reports sent by the general public (via Internet) into numeric intensity values. The CIIM map shows 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 2nd Quarter of 2004

DATE-(UTC)-TIME	LAT(N)	LON(W)	DEP	MAG	COMMENTS	CIIM	Shake Map
yy/mm/dd hh:mm:ss	deg.	deg.	km				
04/04/15 06:32:14	46.93	121.97	12.6	2.3	18.8 km WNW of Mt Rainier, WA		
04/04/25 14:42:33	47.82	121.86	17.7	2.5	8.7 km ESE of Monroe, WA		
04/05/10 13:22:59	47.67	120.27	0.0	1.8	4.2 km WNW of Entiat, WA		
04/05/13 19:43:14	47.91	124.24	0.0	3.1	10.9 km ESE of Forks, WA		✔
04/05/17 13:03:37	46.94	123.18	41.6	2.7	23.3 km ESE of Satsop, WA		
04/06/03 09:45:00	46.94	123.18	41.6	2.7	Meteor Burst - not earthquake 43 km over Snohominsh, WA	✔	
04/06/10 18:09:06	47.18	123.83	0.1	2.3	23.6 km N of Aberdeen, WA		

DATE-(UTC)-TIME	LAT(N)	LON(W)	DEP	MAG	COMMENTS	CIIM	Shake Map
yy/mm/dd hh:mm:ss	deg.	deg.	km				
04/06/12 15:12:09	47.22	123.81	0.0	2.6	28.1 km N of Aberdeen, WA		
04/06/17 09:16:42	46.67	118.23	17.6	3.4	67.2 km N of Walla Walla		
04/06/20 19:32:12	46.62	121.88	4.0	2.6	26.8 km SSW of Mt Rainier, WA		
04/06/24 07:57:52	48.54	122.60	19.9	2.8	24.1 km NW of Mount Vernon, WA		
04/06/25 01:41:32	42.04	120.25	13.4	3.0	17.8 km SSE of Lakeview, OR		
04/06/25 21:48:31	46.62	121.89	0.2	3.9	27.0 km SSW of Mt Rainier, WA	✔	✔
04/06/27 03:24:42	42.07	120.24	11.4	3.2	15.6 km SSE of Lakeview, OR		
04/06/27 07:00:14	42.09	120.24	11.6	3.9	13.9 km SE of Lakeview, OR	✔	
04/06/27 07:03:16	42.07	120.24	10.4	3.2	15.7 km SSE of Lakeview, OR		
04/06/27 11:32:37	42.07	120.24	6.9	3.0	15.2 km SE of Lakeview, OR		
04/06/27 11:40:37	48.41	122.24	0.0	2.2	6.9 km E of Mount Vernon, WA		
04/06/28 03:58:48	48.41	122.23	1.5	2.0	7.4 km E of Mount Vernon, WA		
04/06/29 01:38:49	42.05	120.23	14.3	2.7	17.3 km SSE of Lakeview, OR		
04/06/30 12:21:45	42.03	120.23	13.8	4.4	19.6 km SSE of Lakeview, OR	✔	
04/06/30 18:59:45	42.07	120.25	3.6	2.5	15.4 km SSE of Lakeview, OR		

OREGON

During the second quarter of 2004, a total of 68 earthquakes were located in Oregon between 42.0 degrees and 45.5 degrees north latitude, and between 117 degrees and 125 degrees west longitude. Two areas of Oregon had earthquake swarms this quarter. The first swarm was in April and May near Jordan Valley. The second swarm began in early June near Lakeview, Oregon. There were eight felt earthquakes in Oregon this quarter; all part of the earthquake swarm near Lakeview.

Jordan Valley, Oregon Swarm: On April 22 an earthquake swarm began suddenly just west of Jordan Valley (close to 117 degrees W, 43 degrees N; on the Oregon-Idaho Border about 100 km south-southwest of Boise, Idaho). Swarm activity continued through early June and more than 150 events, most of them magnitude 1.0 or larger, were recorded. The largest event had a magnitude of about 3.4, occurred on 17 May, and may have been felt by a few local residents. Portable seismographs were deployed by Jim Zollweg of Boise State University, and data indicated the earthquakes were occurring beneath Antelope Reservoir west of Jordan Valley at a depth of about 7 km. The Jordan Valley swarm occurred in an area that has been almost completely devoid of located microearthquakes for more than 20 years (The Southwest Idaho seismic network operates a station 58 km away, and earlier activity would have been detected). It is in a transition zone between Basin and Range morphology to the west and the Owyhee Highlands to the east. A Holocene volcanic field is located just north of the swarm area, but there are also possible fault structures in the immediate area.

At the time the Jordan Valley swarm started, the PNSN had no instrumentation in this area and did not record these events. The Southwest Idaho seismic network, operated by Jim Zollweg of Boise State University, did record the sequence but with very poor ability to resolve location or depth of the earthquakes. The Southwest Idaho seismic network has limited resources, does not receive funding from the Advanced National Seismic System (ANSS), and is currently unable to exchange real-time data with the PNSN. Because of concern about a poorly monitored earthquake swarm occurring close to the Antelope Reservoir dam, the Oregon Dept. of Mineral Industries (DOGAMI), in cooperation with the USGS and PNSN, assisted in siting, installation, and telemetry for two instruments; installed at Burns and Jordan Valley at the end of June. This substantially improves monitoring of Jordan Valley, and also coincidentally improved coverage of the second Oregon sequence near Lakeview, which included earthquakes larger than magnitude 4.0. Lakeview is a fair-sized town with many unreinforced masonry buildings.

Lakeview, Oregon Swarm: The swarm near Lakeview, near the California Border, may have begun as early as June 4, when a magnitude 2.5 earthquake was located, apparently about 20 km north of the main cluster. Activity increased on June 25, with 6 located events. The sequence continued to accelerate, producing a magnitude 4.4 earthquake felt earthquake on June 30. A total of 32 earthquakes (8 of them felt, including 6 magnitude 3.0 or larger) were located between 41.6-42.4 N latitude and 120.0-120.7 W longitude.

These earthquakes lie in an area where seismicity is infrequent, and there are few stations nearby. The area is also between the Pacific Northwest and California networks, so two different groups are providing data and analysis. The PNSN and California Integrated Seismic Network **(http://www.cisn.org/**) are exchanging data for these events. Additional information can be found in special web pages: **http://www.pnsn.org/NEWS/PRESS_RELEASES/LAKEVIEW_2004.html** Several portable seismographs are being operated in the area by the Southwest Idaho seismic network with funding from DOGAMI, but data is not telemetered.

An apparent north-south alignment of these earthquakes, seen in our standard network locations, is most likely due to location errors because of the limited number of seismographs in the area. A careful relocation of some of the larger earthquakes suggests that the events likely originate fairly close together. Jim Zollweg of the Southwest Idaho seismic network reports that the events are occurring in the mountain range east of the Goose Lake fault, at depths of 4-8 km, and that microearthquake event rates are high, often 500-1000/day. The sequence is located in the basin and range geologic province, and focal mechanisms indicate normal faulting, typical of the region. The basin and range is capable of producing vigorous earthquake sequences and swarms. The Lakeview swarm is continuing into July, 2004.

WESTERN WASHINGTON SEISMICITY

During the second quarter of 2004, 360 earthquakes were located between 45.5 degrees and 49.5 degrees north latitude and between 121.0 degrees and 125.3 degrees west longitude. Twelve earthquakes were felt this quarter in western Washington. Details are in Table 2.

The largest felt earthquake in western Washington was a magnitude 3.9 event on June 25 (UTC), located about 27.0 km south-southwest of Mt Rainier, WA at a very shallow depth (less than 1 km). The deepest earthquake in western Washington this quarter was a magnitude 0.8 event at 85 km depth located about 13 km west-southwest of Skykomish, WA on June 14 (UTC).

On June 3, 2004 at 9:40 UTC a meteor burst was seen, heard and felt in the central Puget Sound. The PNSN recorded this event on many seismograph stations throughout the area. From what we can see on our records, this appears to be a single explosive source rather than a "sonic boom" type moving source. Our estimate of the location of the "boom" places it at an altitude of 43 km over Snohomish, WA. When it arrived near Snohomish it apparently exploded.

Beginning in late April and ending in mid-May, an “Episodic Tremor and Slip” (ETS) event was recorded in south-western Washington. Although ETS events have occurred in southern British Columbia and northern Washington every 14 months or so over the last 10 years (Science, May 25, 2001, V. 292, pp. 1525-1528), none had previously been noted in southwestern Washington. This quarter’s ETS event began in central Puget Sound and reached as far south as Portland, OR. Recent installation of GPS instruments and heightened alertness to the tremor that accompanies events made it possible to observe the ETS in southern Washington. A brief period of tremor was observed in northern California in late May, but no slip was reported from this area.

Three small research arrays were deployed in northwestern Washington and on Vancouver Island in anticipation of tremor on the northern segment by a group of scientists including Steve Malone and Wendy McCausland of the UW. Additional info is available at: **http://www.pnsn.org/NEWS/PRESS_RELEASES/TREMOR.html**

WASHINGTON CASCADE VOLCANOES

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). Only one flagged "L" or "S" was located at Mount Rainier this quarter although 59 "L" or "S" events were recorded, but were too small to locate reliably. Type L and S events are not shown in Fig. 4.

A total of 66 tectonic events (25 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 on June 25; a magnitude 3.9 event at a depth of less than 1 km located about 27 km south-southwest of the summit. This quarter, 41 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 14 (6 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.

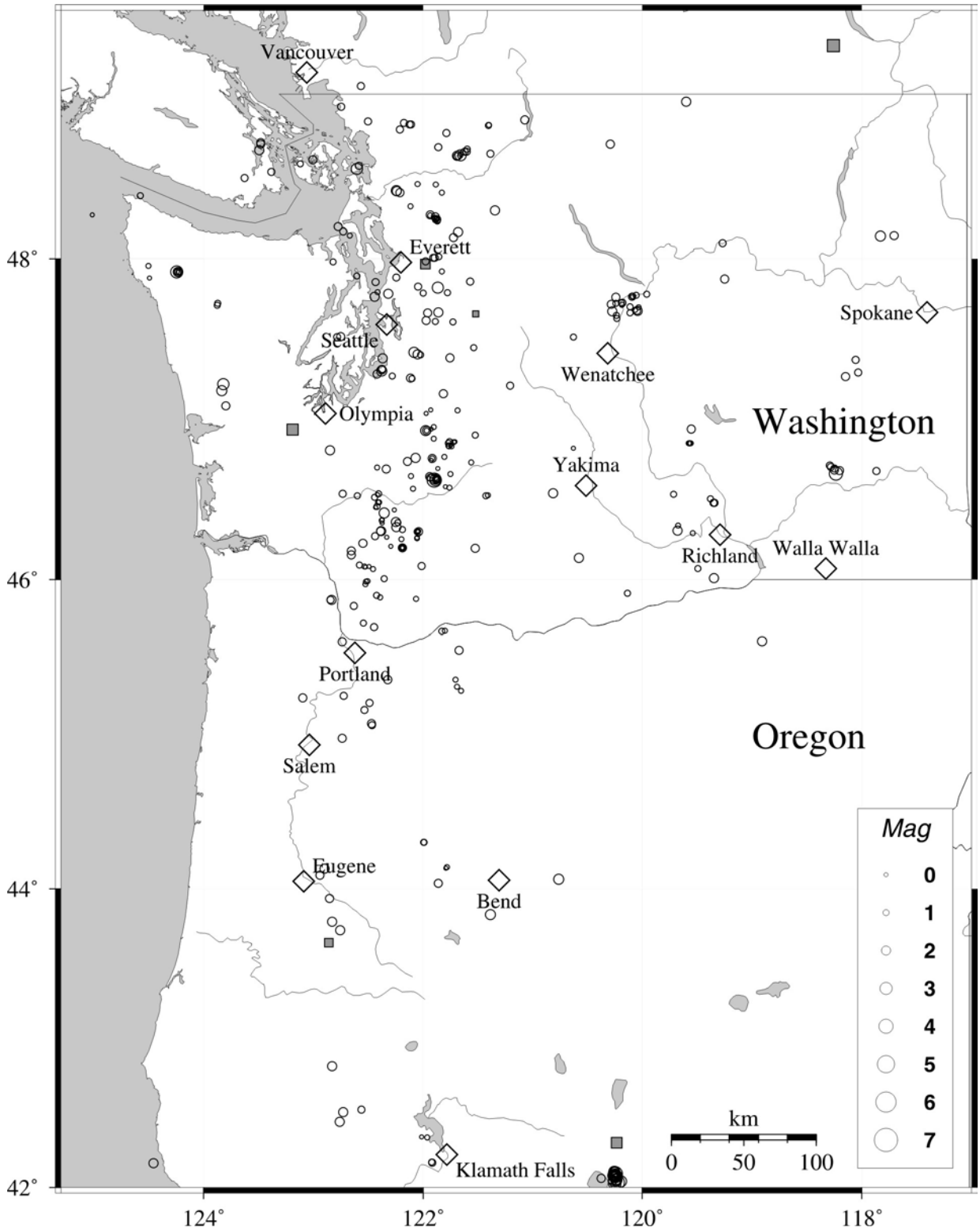

Figure 1. Earthquakes with magnitude greater than or equal to 0.0 (Mc>=0.0). Unfilled diamonds represent cities. Quakes shallower than 30 km are indicated by circles, and deeper quakes by filled squares.

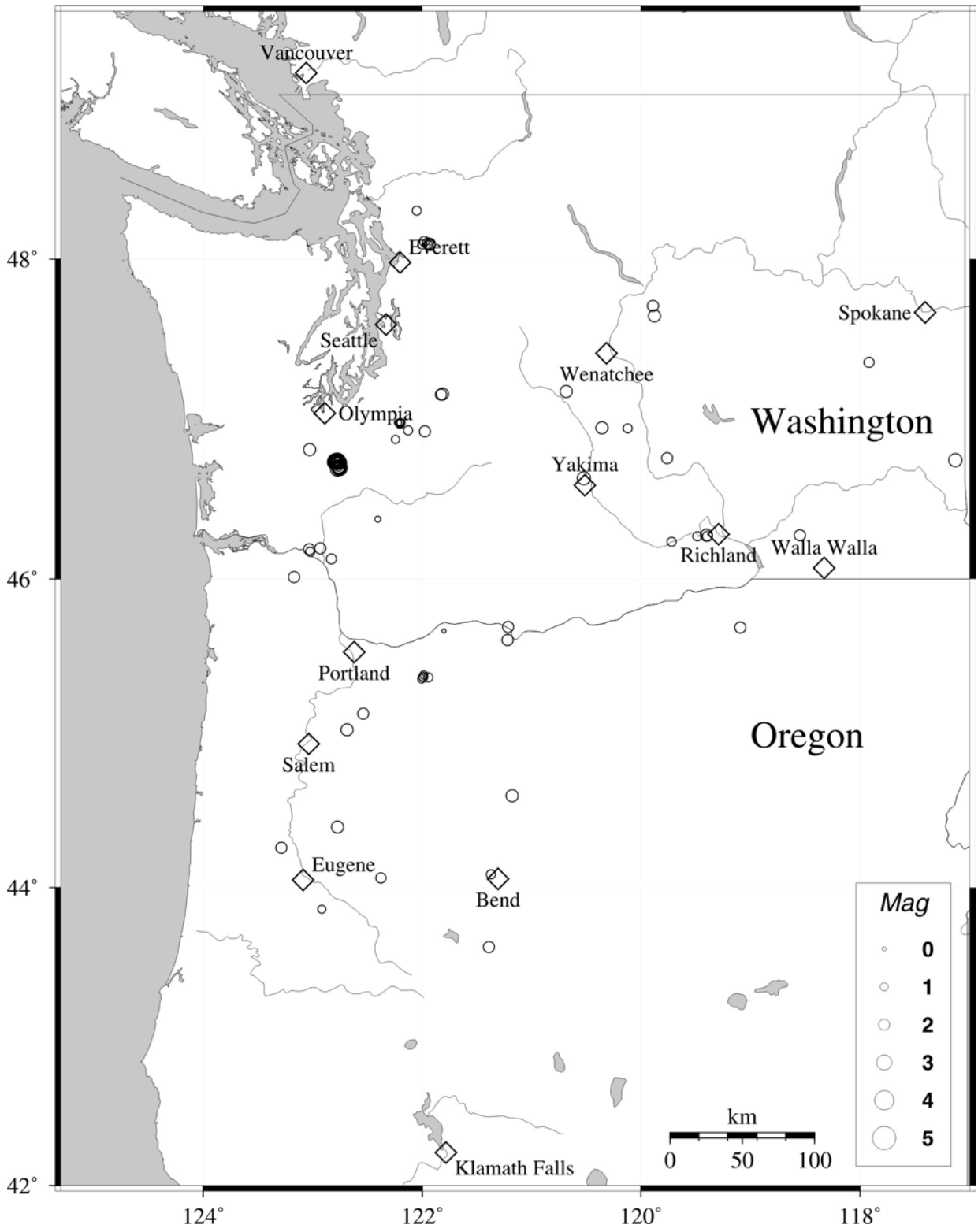

Figure 2. Blasts and probable blasts. Unfilled diamonds represent cities.

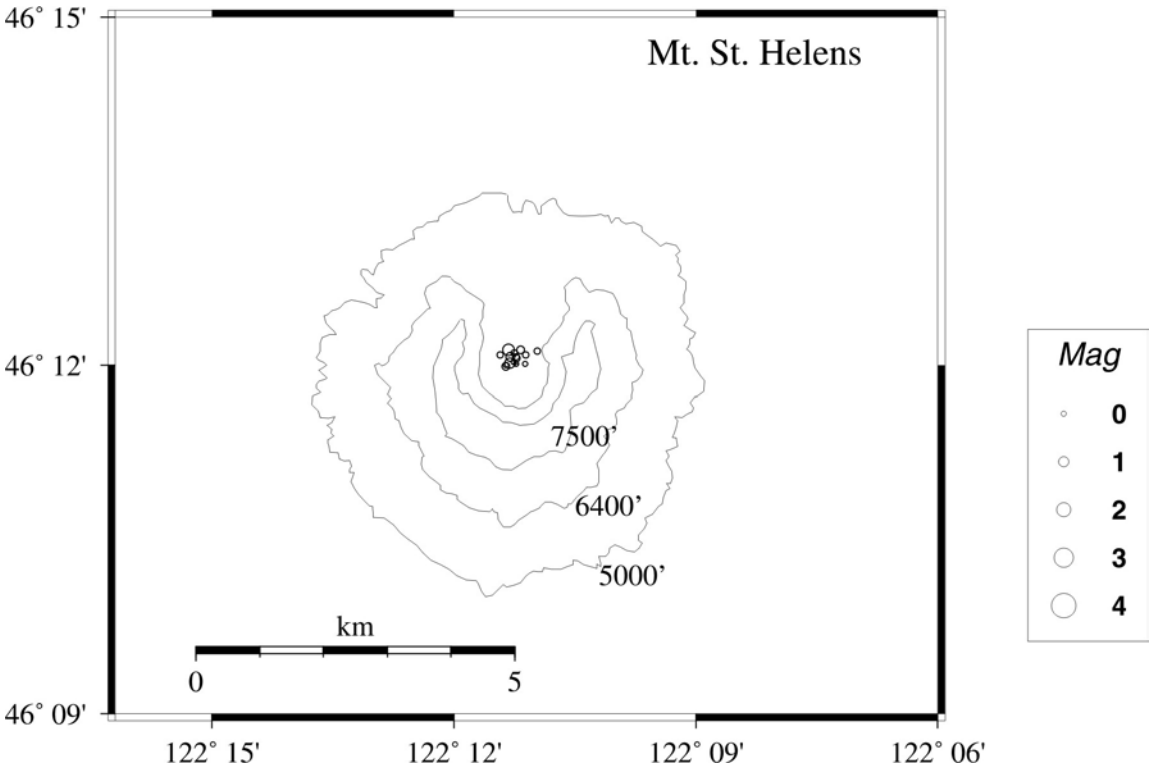

Figure 3. Earthquakes at Mt. St. Helens, M>0.0.

Plus' symbols indicate depth less than 1 km. Circles indicate depth greater than 1 km. Elevation contours shown in feet

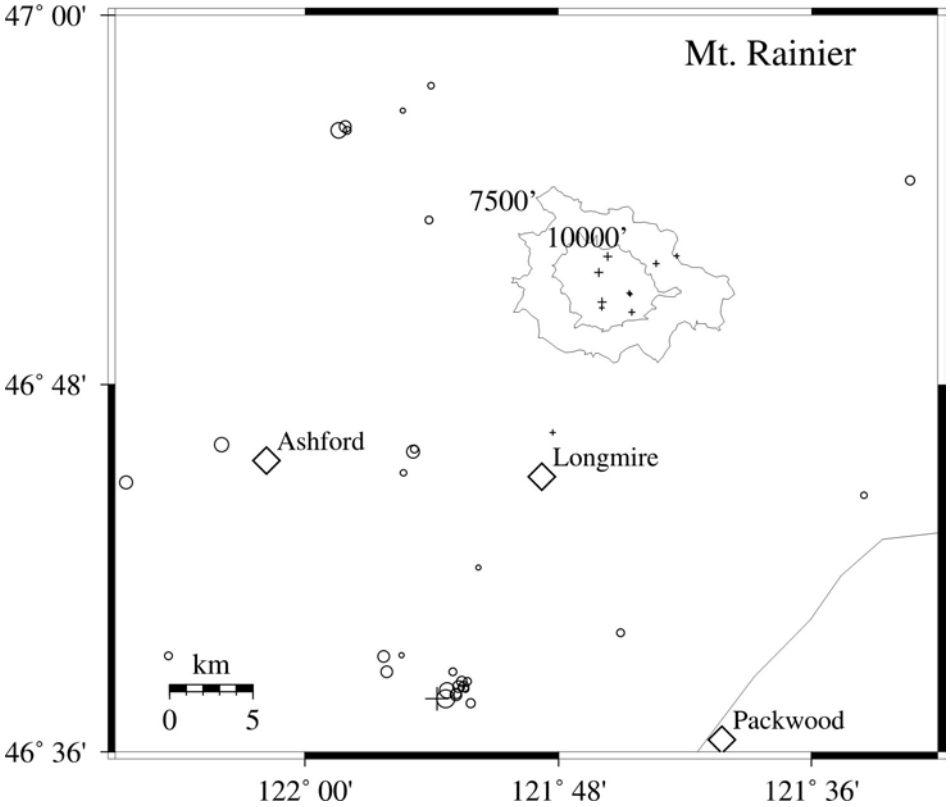

Figure 4. Earthquakes at Mt. Rainier, M>0.0.

Mount St. Helens

Figure 5 shows volcano-tectonic earthquakes near Mount St. Helens. Low frequency (L) and avalanche or rockfall events (S) are not shown.

This quarter, 87 tectonic earthquakes were located at Mount St. Helens in the area shown in Fig. 5. Of these earthquakes, 16 were magnitude 0.0 or larger and 9 were deeper than 4 km. The largest tectonic earthquake at Mount St. Helens this quarter was a magnitude 1.4 event at about 2 km depth on Mayl 24 at 01:38 UTC. It was located about 0.5 km north-northeast of the summit.

No type "S" or "L" events were located at Mount St. Helens this quarter, although 104 "L" or "S" events too small to locate were recorded.

EASTERN WASHINGTON SEISMICITY

During the second quarter of 2004, 61 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 3.4 event on June 17th. It occurred at a depth of about 19 km and was located about 67 km north of Walla Walla. It was reported felt and was part of a small sequence that included 2 foreshocks on the same day and 3 aftershocks over the following week.

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**.

EARTHQUAKE CATALOG, 2004-B

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

TABLE 3. Tectonic earthquakes, 2nd quarter, 2004, magnitude 2.0 and larger

Within the area 42-49.5 degrees north latitude and 117-125.3 degrees west longitude

Apr-04											
DAY	**TIME**	**LAT**	**LON**	**DEPTH**	**M**	**NS/NP**	**GAP**	**RMS**	**Q**	**MOD**	**TYP**
5	29:45.9	47 46.11	122 26.47	25.71	2.1	59/062	40	0.28	BA	P3	
13	02:41.7	42 26.77	122 45.66	0.46	2.0	10/011	141	0.34	CC	K3	
14	11:13.4	46 08.19	120 34.80	11.57	2.1	27/029	81	0.27	BC	E3	
15	32:14.5	46 56.25	121 58.40	12.58	2.3	53/057	24	0.15	BA	C3	F
17	26:15.4	46 25.28	122 21.28	13.01	2.2	39/042	49	0.16	BA	S3	
17	10:47.2	42 09.80	124 27.33	2.76$	2.1	5/006	293	0.47	DD	K3	
25	42:33.3	47 49.41	121 52.01	17.7	2.5	55/058	55	0.22	BA	P3	F
29	45:41.9	47 25.49	122 04.75	21.69	2.3	63/067	40	0.17	BA	P3	
May-04											
DAY	**TIME**	**LAT**	**LON**	**DEPTH**	**M**	**NS/NP**	**GAP**	**RMS**	**Q**	**MOD**	**TYP**
3	10:14.8	45 52.28	122 50.07	21.7	2.1	42/044	54	0.13	AB	C3	
9	49:07.6	47 40.97	120 02.50	5.92	2.1	12/013	90	0.21	BB	N3	
13	43:14.1	47 55.16	124 14.64	0.03*	3.1	22/022	109	0.42	CC	P3	F
15	01:37.2	49 17.44	118 15.48	30.14*	3.1	10/010	273	0.22	BD	N3	
17	03:37.3	46 56.71	123 11.28	41.57	2.7	46/048	69	0.13	AA	P3	F
25	37:00.1	48 57.27	119 36.09	0.05*	2.0	10/010	251	0.29	BD	N3	

TABLE 3. Tectonic earthquakes, 2nd quarter, 2004, magnitude 2.0 and larger											
May-04											
DAY	**TIME**	**LAT**	**LON**	**DEPTH**	**M**	**NS/NP**	**GAP**	**RMS**	**Q**	**MOD**	**TYP**
25	21:56.7	48 08.44	117 49.77	2.09	2.2	6/006	182	0.21	CD	N3	
28	41:36.5	48 17.79	121 20.50	10.08	2.0	15/016	211	0.22	BD	C3	
28	56:50.9	44 03.75	120 45.85	21.60$	2.4	10/010	183	0.38	CD	O0	
Jun-04											
DAY	**TIME**	**LAT**	**LON**	**DEPTH**	**M**	**NS/NP**	**GAP**	**RMS**	**Q**	**MOD**	**TYP**
3	51:52.5	43 49.70	121 23.21	4.2	2.2	18/018	100	0.23	BC	O0	
4	53:55.2	42 18.14	120 13.98	30.78	2.5	14/015	103	0.61	DB	K3	
10	09:06.9	47 11.25	123 50.14	0.05*	2.3	27/027	160	0.47	CC	P3	F
11	39:51.7	47 18.66	122 22.58	24.7	2.3	62/065	35	0.15	AA	P3	
11	28:49.7	48 37.89	121 39.34	0.03*	2.8	26/028	159	0.44	CC	C3	
12	12:09.2	47 13.72	123 49.10	0.03*	2.6	35/035	155	0.53	DC	P3	F
17	16:42.5	46 40.25	118 14.19	17.6	3.4	33/033	150	0.27	BD	E3	F
20	32:12.4	46 37.73	121 53.34	3.98	2.6	52/055	48	0.20	BC	C3	F
24	57:52.5	48 32.88	122 36.03	19.89	2.8	48/050	78	0.29	BB	P3	F
25	39:04.0	42 06.38	120 15.22	4.36$	2.6	15/016	141	0.56	DC	K3	
25	41:32.2	42 02.86	120 15.28	13.41	3.0	20/021	121	0.78	DB	K3	F
25	51:39.9	42 04.72	120 15.84	11.21	2.6	15/016	115	0.57	DB	K3	
25	13:19.4	42 04.67	120 15.20	11.36	2.4	16/017	118	0.58	DB	K3	
25	36:01.7	42 04.83	120 14.77	12.34	2.7	15/016	119	0.50	DB	K3	
25	48:31.6	46 37.74	121 53.75	0.18	3.9	99/099	24	0.34	CC	C3	F
25	44:16.7	46 38.00	121 53.26	4.68	2.3	42/045	45	0.12	AC	C3	
26	03:29.9	42 06.09	120 15.10	0.03*	2.2	13/013	140	0.25	BC	K3	
26	06:04.3	42 05.38	120 15.60	25.96	2.2	13/013	140	0.42	CD	K3	
27	24:42.6	42 04.44	120 14.60	11.37#	3.2	18/018	121	0.28	BB	K3	F
27	00:14.9	42 05.50	120 14.72	11.55*	3.9	19/020	118	0.29	BB	K3	F
27	03:16.0	42 04.44	120 14.52	10.37	3.2	20/021	121	0.50	DB	K3	F
27	14:32.1	42 05.77	120 14.89	4.41	2.1	12/013	140	0.29	BC	K3	
27	42:18.3	42 02.44	120 11.73	15.18$	2.7	16/018	138	0.58	DC	K3	
27	36:55.4	42 04.82	120 14.66	7.28	2.6	14/015	120	0.13	AC	K3	
27	26:45.8	42 05.15	120 14.90	0.03*	2.3	10/010	139	0.25	BD	K3	
27	32:37.8	42 04.76	120 14.46	6.89	3.0	16/017	121	0.23	BC	K3	F
27	40:37.4	48 25.07	122 14.69	0.02*	2.2	23/023	54	0.44	CB	P3	F
27	24:15.7	42 04.12	120 15.10	8.63	2.4	15/016	119	0.41	CC	K3	
28	58:48.6	48 24.87	122 14.32	1.47	2.0	10/010	95	0.12	AB	P3	F
28	35:23.5	42 04.82	120 14.00	5.96*	2.4	16/017	122	0.22	BC	K3	
28	48:49.2	42 04.95	120 14.81	0.02*	2.1	10/010	235	0.24	BD	K3	
28	53:17.4	42 05.03	120 15.20	0.03*	2.3	10/010	235	0.17	BD	K3	
29	38:49.8	42 03.59	120 14.19	14.28	2.7	17/018	124	0.57	DB	K3	F
29	14:50.7	47 24.84	122 03.04	6.57	2.0	32/035	50	0.20	BC	P3	
30	18:01.9	42 04.41	120 14.42	4.14	2.5	21/021	134	0.62	DD	K3	
30	20:53.8	42 02.54	120 14.32	1.34$	2.3	23/023	136	0.68	DD	K3	
30	21:45.6	42 02.10	120 14.30	13.78$	4.4	36/036	137	1.08	DD	K3	F
30	23:57.1	42 01.27	120 14.49	1.49$	2.4	16/016	144	0.71	DD	K3	
30	46:39.9	42 03.09	120 16.20	16.65	2.1	11/011	141	0.53	DD	K3	
30	36:00.2	42 03.18	120 14.26	12.11$	2.5	16/016	142	0.43	CD	K3	
30	59:45.2	42 04.24	120 15.33	3.56	2.5	18/018	140	0.37	CD	K3	F

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 and related hazards. Our program offers lectures, classes, lab tours, workshops, and 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 PNSN audio library system received 300 calls this quarter. Our audio library provides several recordings; we have resumed regular updating of messages concerning current seismic activity. 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 available information.

Internet outreach:

PNSN staff replied to about 135 e-mail messages from the public seeking information on a variety of topics via the seis_info@ess.washington.edu email address. Routine questions are typically responded to within a day; complex or sensitive questions are routed to the appropriate staff person for a more in-depth response. These replies include assistance with hazard assessments and legal issues, consultations with government agencies, and support for engineering issues related to strong motion data.

The California Integrated Seismic Networks (CISN) has developed a product to reliably deliver real-time earthquake hazards information to critical users. The user runs an application called "CISN Display", which receives and displays information. CISN Display can display many more types of information than the CUBE-based RACE (Rapid Alert for Cascadia Earthquakes) systems currently in use. The CISN Display beta test version was distributed to select users who provide feedback to PNSN staff, CISN Display clients are now receiving PNSN recent earthquake data and links to our ShakeMaps, which are automatically generated following significant earthquakes. Following the scheduled late summer 2004 release of version 1 of the CISN Display, the PNSN plans to repackage the product with additional data layers for wider release within Washington and Oregon.

K-20 Education Outreach:

PNSN and USGS staff provided 12 Seismology Lab tours and presentations for K-20 students and teachers serving about 240 students this quarter. The PNSN also maintains an email list-service and distributed monthly newsletters to over 50 local K-20 educators, subscribers interested in earth sciences education. Bill Steele also provided lectures to a UW Hazard Mitigation Class in the Department of Urban Planning and to the ESS Earthquakes Class.

Media Relations:

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. The PNSN often coordinates information releases with other organizations, including the USGS Western Region, the Cascades Volcano Observatory, and the Oregon Department of Geology and Mineral Industries (DOGAMI).

This quarter the PNSN cooperated with DOGAM in responding to numerous requests for information and interviews regarding swarms of earthquakes in southern Oregon. PNSN provided information concerning the swarms to DOGAMI, and they handled media inquiries.

Three unusual events caused some media uproar this quarter. The first was the TV mini-series "10.5" in early May, with a seriously stupid and absurd story line. The second was the June 3, 2004 meteor burst over Snohomish, which was seen, filmed, heard and felt in the central Puget Sound. The third was the onset of an "Episodic Tremor and Slip" (ETS) event in southwestern Washington in late April. Television, radio, and newspaper coverage continued through the quarter, both of the tremor and because three research arrays were deployed (under other funding) by the PNSN's Steve Malone and Wendy McCausland , to record signals from an expected ETS event in northwestern Washington and southern Vancouver Island. See the seismicity section for western Washington for details.

Meetings, Presentations and Visitors:

- Bill Steele staffed a booth with CREW at the two day annual Washington State Partners in Preparedness Conference attended by over 400 public and private sector emergency managers.
- Meetings were held this quarter with Seattle Emergency Management and Seattle and King County IT staff who offered advice and support for PNSN telemetry projects.
- Steve Malone participated in a meeting and several conference calls regarding ShakeMap, ShakeCast, and the CISN Display. Other participants included FEMA, Washington State EMD, the PNSN, and USGS scientists. The emergency response agencies in the region are anxious to become familiar with these products and to develop software to interface with ShakeCast. The PNSN has not begun to use ShakeCast routinely and does not currently have a programmer on staff to work with counterparts in the emergency management community.
- Steve Malone, Bill Steele, and graduate student Wendy McCausland hosted the UW College of Arts and Sciences Dean's Circle, private contributors to College programs, for an evening of seismology providing an overview of hazards, research activities, and the Seismology Lab.
- Dr. David Applegate and Dr. Mike Blanpied, USGS Earthquake Program representatives from the Survey's National headquarters in Reston Virginia spent a day in meetings with PNSN representatives to discuss network operations and challenges.
- Bill Steele, Craig Weaver, and Kathy Troost of the Seattle Geologic Mapping Project held a half-day workshop on geologic hazards and mapping for the City of Mercer Island department heads.
- Steve Malone, Guy Medema, and Wendy McCausland attended the annual meeting of the SSA