Instrumentation to Improve the Washington Regional Seismograph Network 1994
1434-92-G-2195 S.D. Malone and R.S. Crosson, P.I.s

Geophysics Program
University of Washington
Seattle, WA 98195
(206) 543-8020
e-mail: steve or bob@geophys.washington.edu
Oct 1, 1993 - Sept. 30, 1994

This contract is for the purchase and installation of four new, high quality broad-band digital seismograph stations as an addition to the Pacific Northwest Seismograph Network (PNSN; formerly known as the Washington Regional Seismograph Network). It also includes funding for the development of the data acquisition process and integration of these data into the routine data collection and analysis procedures. Seismic data from these stations are now being routinely merged with PNSN short-period seismic data. Since July of 1993, 5,400 broad-band data traces for 2,800 different events have been recovered and archived.

Three of the four stations funded under this contract plus a similar prototype station were installed and began operating over a year ago. The final station will be installed in early 1995. By the end of the contract period, there will be a total of 10 high quality seismograph stations operating in the Pacific Northwest (5 operated by the PNSN, two by USNSN, one by IRIS/USGS -- COR, and two by the University of Oregon; PIN and DBO).

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Investigations undertaken

This contract is for the purchase and installation of four new, high quality broad-band three-component digital seismograph stations as an addition to the Pacific Northwest Seismograph Network (PNSN; see the report for Joint Operating Agreement 1434-92-A-0963). It also includes funding to develop software for recovering and integrating the broad-band data into our routine data analysis procedures. In addition to the four stations supported under this contract, a prototype station (LON), situated on the same pier as the DWWSSN station at Longmire WA (near Mount Rainier), has been operating since early 1993. By the end of the contract period, there will be a total of 10 high quality seismograph stations operating in the Pacific Northwest (5 operated by the PNSN, two by USNSN, one by IRIS/USGS -- COR, and two by the University of Oregon; PIN and DBO).

Results

In addition to the LON prototype, three of the new stations are fully operational, and data from them are routinely merged with PNSN short-period data. Since July of 1993, we have recovered 5,400 broad-band data traces for 2,800 different events. Installation of the final station (with on-site recording) will be completed in early 1995 on Marrowstone Island, Washington. Figure 1 shows the current PNSN network configuration (both broad-band and short-period).

During this contract period, we upgraded two of the four installed broad-band three-component stations. All installed recorders now have GPS time-code receivers and 24 bits/sample dynamic range. Three of the stations (LON at Longmire, LTY at Liberty, and SSW at Satsop; all in Washington) time-stamp, digitize, and record data on-site. We recover selected broad-band data from these stations via phone lines using automated procedures that run late at night (to minimize long-distance charges). The fourth station, (TTW) near Tolt, Washington, also digitizes and time-stamps data on-site, but continuously telemeters data to the UW Seismology Lab where it is recorded as a continuous data stream. Individual events are extracted from the data stream and, with data from other broad-band stations (including COR, PIN, and DBO as well as LTY, SSW, and LON), are merged and archived with data from PNSN short-period stations. The broad-band event data are also translated to IRIS-SEED format and submitted to the IRIS Data Management Center for archive and distribution.

To allow broad-band data to be merged into the PNSN short-period data stream, the PNSN has modified both trace data and pickfile (phase arrival times) formats, and associated data-processing software. The new working trace data format (UW-2) allows us to accommodate data of varying durations, sample rates, start times, and formats (e.g., integer, floating point, etc.), is extensible without affecting existing processing programs, and is backward-compatible with our original (UW-1) format.

The new UW-2 pickfile format provides full support for three-component stations, flexibility to represent arbitrary phase types (our old UW-1 format could only represent P and S phases) such as Pn and PmP, and a number of other advantages, and is also backward compatible. Interactive viewing of both trace and pickfile data is provided through **Xped** (X pick editor), an X window application that allows the user to display trace and pick information, modify picks, run location programs, and perform other data analysis functions.

We are receiving data from the USNSN via VSAT and recording it continuously. We are currently developing software that will allow the USNSN data to be merged into our event data files. Eventually, the data from our continuously transmitting site (TTW) will be reformatted into USNSN format and transmitted to the National Seismic Network in Golden, CO via VSAT.

One of our students, Gia Khazaradze, has developed a technique to generate synthetic Wood-Anderson records from the broad-band data. This provides several independent measurements of local magnitudes from the broad-band data, and should improve our ability to provide more robust magnitude estimates.

Abstracts

Khazaradze, G. and S.D. Malone, 1994, Determination of local magnitude using Pacific Northwest Seismic Network Broadband Data, EOS, Vol. 75, Supplement to No. 44, p. 460.

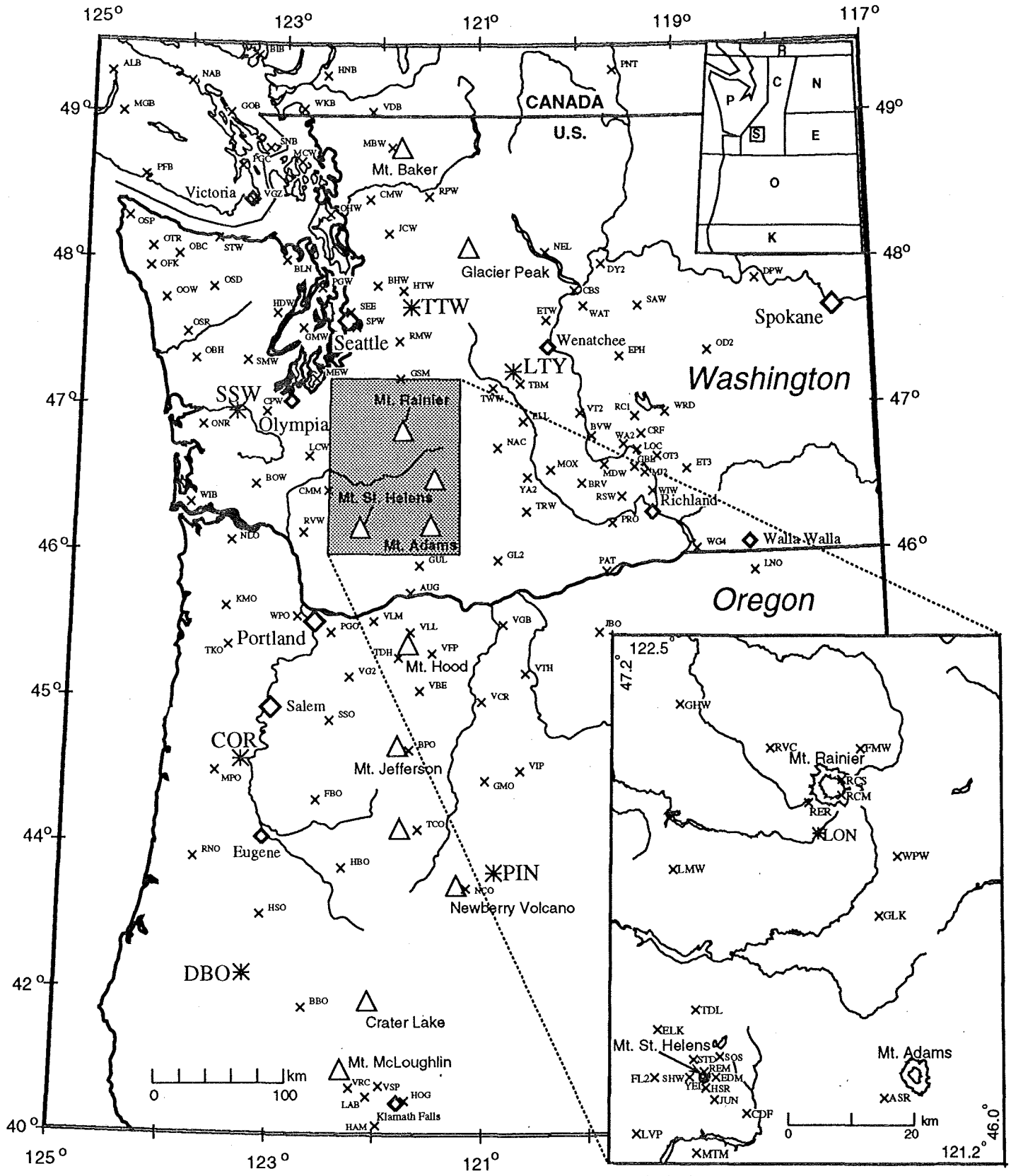

Figure 1. Locations of stations operating in the Pacific Northwest at the end of 1994. Short-period stations are shown by the "x" symbol, while broad-band stations are designated by the larger asterisks. The locations of volcanic centers are shown by triangles, and cities are indicated by white-filled diamond shapes. Most stations are operated by the PNSN, but station COR is operated by Oregon State University, and stations DBO and PIN are operated by the University of Oregon. The upper inset shows the eight regions in which different crustal velocity models are used to locate hypocenters (P, Puget Sound; C, Cascades S, Mt. St. Helens; N, northeast Washington; E, southeast Washington; O, northern Oregon; K, southern Oregon; and R, regional velocity model). The lower inset shows station locations in the vicinities of Mts. Rainier, St. Helens, and Adams.