Annual Project Summary

Western Great Basin Seismic Network Operations

External Grant Award Number 01HQAG0009
Glenn P. Biasi, Principal Investigator
Institution: University of Nevada Reno
Seismological Laboratory
MS-174
Reno, NV 89557
Ph: (775) 784-4576
FAX: (775) 784-4165
glenn@seismo.unr.edu
http://www.seismo.unr.edu

Program Element: III
Key Words: Regional Seismic Hazards, Real-time Earthquake Information, Seismotectonics

This report summarizes results and progress for the period from October 1, 2000 through September 30, 2001. During this period the Nevada Seismological Laboratory (NSL) continued to operate the Western Great Basin Seismic Network and to pursue USGS interests under the National Earthquake Hazard Reduction Program. The Western Great Basin Seismic Network covers from the eastern Sierra Nevada Mountains to central Nevada, with regional coverage focused on the Walker Lane Tectonic Belt. Sierran micro-plate motion relative to central Nevada, amounting for approximately 20 percent of the total

Pacific-North American relative motion, is the leading source of earthquake hazard in eastern California and western Nevada. Interaction between this strike-slip regime and ongoing Basin and Range extension gives the western Great Basin region unique characteristics for tectonic and seismic hazard research.

Specific tasks for the reporting period included:

1. Seismic Network Operations
2. Real-time Integration of Networks
3. Access to and Distribution of Earthquake Information
4. ANSS Strong Motion Installation

The fourth task was added in the spring of 2001, and funded in late June 2001. The timing and scope of this task required significant levels of manpower and staff attention.

SEISMIC NETWORK OPERATIONS

Fiscal Year 2001 was the first complete year operated entirely under the Antelope Real-Time software system. Until December 2000 the CUSP system was retained for backup and comparison purposes. Joint operation of analog and three-component digital stations approximately doubled the number of located earthquakes over the operation of the digital and analog networks separately. The increase in located earthquakes has significantly increased the workload on network analysts.

A total of 6958 earthquakes were located in the Western Great Basin Network region during FY 2001. The tectonic complexity of the Walker Lane Belt is evident by the concentration of Ml>3.5 earthquakes between 37 and 38.5 degrees north, where a major right step is suggested from seismic and tectonic evidence. One earthquake large enough to be widely felt in the Las Vegas Valley occurred in the past year, an Ml 3.5 event on February 4, 2001. Areas of continuing activity include Scottys Junction (37.4N, 117.0W) and Little Skull Mountain (36.7N, 116.5W) in southern Nevada, south and east of the Long Valley region (37.5N, 118.5W), and north of Pyramid Lake (40.5N, 119.5W).

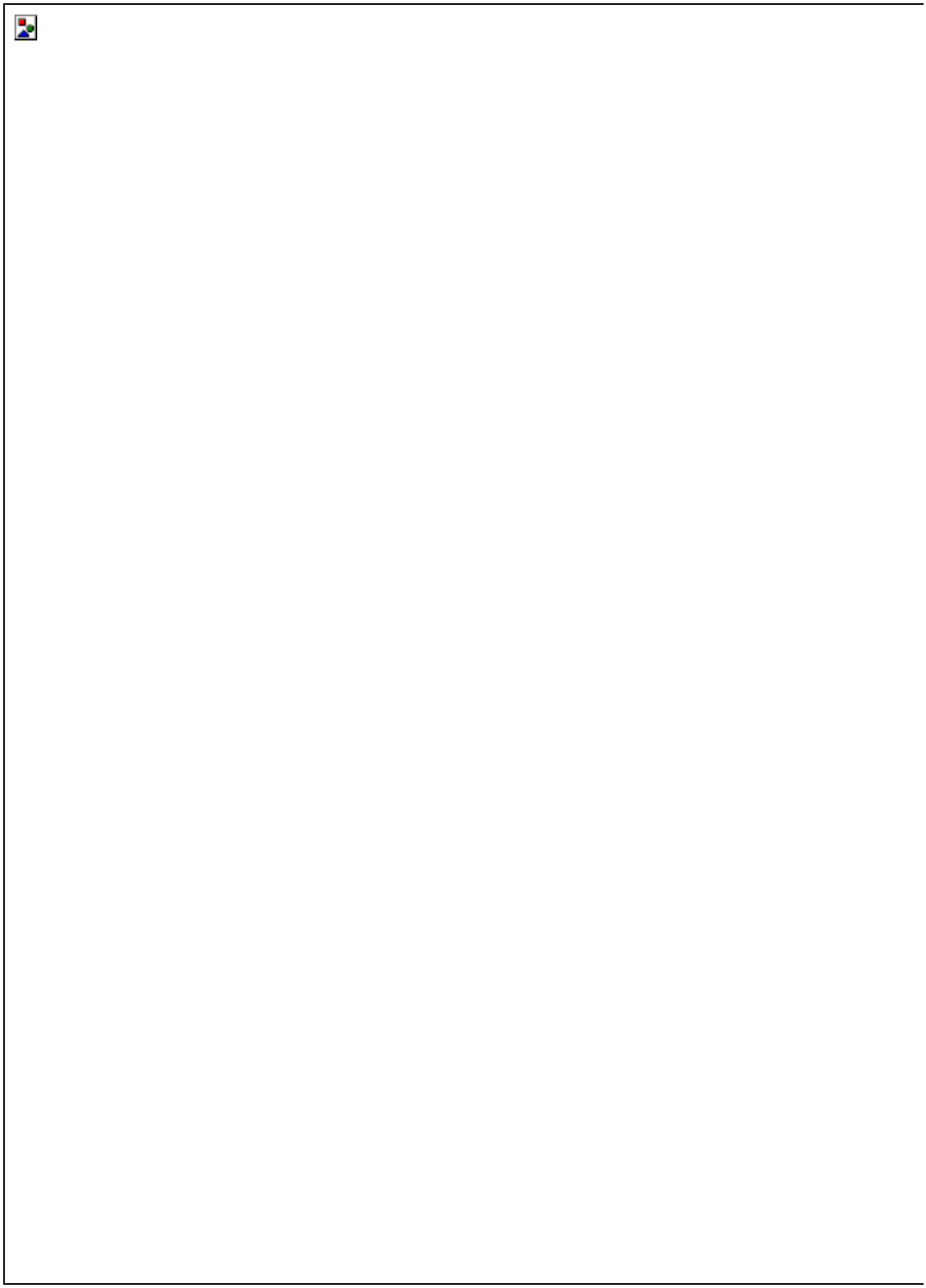

Figure 1. Earthquakes located in FY 2001 by the Western

with Ml>=3.5, and scaled by magnitude.

The largest earthquake in the past year was an Ml 5.3 event on August 10, 2001 at 20:19:26 15 km northwest of Portola, California. This event occurred within an area of recent northwest extension of analog station coverage initiated by our network engineer. Though widely felt, the depth of the mainshock, 17.8 km, probably accounted for the lack of reported damage in the epicentral area. A local retailer reported that the event duration was long enough to allow him to cross his store to hold his most precarious stock. Only a few items fell and nothing was broken. By contrast, a shallower M3.7 earthquake 21 months earlier caused modest loss and breakage. Most of the located aftershocks also occurred at similar depths to the mainshock. Two portable recorders were deployed to record three-component waveforms on scale and to confirm the depths with clear S-minus-P times. The August 10, 2001 event occurred on a recognized trend in previous seismicity, but the contribution of this NW-trending seismic lineation to overall Sierran block motion is not yet known.

REAL-TIME INTEGRATION OF NETWORKS

Extensive integration of networks was maintained by exchange of real-time waveform data throughout the reporting period. Real-time waveform exchanges included networks in Utah, southern California, University of California San Diego, University of California Berkeley, and the USGS NSN, and with the IRIS Data Management Center. Stations imported from Caltech, UCSD, and the Berkeley Digital Seismic Network were used to stabilize hypocentral solutions for regional distance events outside the WGBSN. Capabilities were extended during the reporting period by USGS addition under the ANSS task of a new Ultra-10 computer dedicated to file and waveform sharing, and the purchase of a disk array to improve data archive reliability and access. In the arena of network cooperation, discussions were initiated with the California Integrated Seismic Network to clarify ANSS boundaries and reporting relationships. Historic, physical, and physiographic realities put areas of eastern California within the WGBSN, but ANSS has been organized on state

boundaries, necessitating procedural adjustments and closer network cooperation.

During this reporting period, measures were also initiated for the real-time exchange of strong-motion data being recorded under the ANSS strong-motion component. Software was installed to receive Kinemetrics K-2 strong-motion data together with velocity data from other stations.

ACCESS TO AND DISTRIBUTION OF EARTHQUAKE INFORMATION

NSL distributed seismic data during the reporting period by several methods. The primary public interface for earthquake information is the NSL web page, *http://www.seismo.unr.edu*. This site presently averages 4500 requests/day, and requests span a wide spectrum of public interests. The earthquake catalog from 1852 to the present was made available with mapping capabilities in early 2001. Felt reports are obtained for events greater than M3 in western Nevada. The site was linked this year to the USGS "ShakeMap" pages (*www.pasadena.wr.usgs.gov/shake/*), and an Intermountain-West region added there by USGS Pasadena staff. Data are being archived presently at two locations, the Northern California Data Center and at the IRIS Data Management Center. These data feeds are maintained by Antelope system transfers directly from the real-time acquisition system. Strong-motion data gathered in the Portola earthquake of August 10, 2001 became the first in a new, publicly available archive of strong-motion data. Intended to serve the most common type of data requests, records are in PDF format and accessible by links from the NSL home page.

ANSS STRONG MOTION INSTALLATION

Revision 2, dated June 22, 2001, of the Western Great Basin Seismic Network grant provided funds for the installation and operation of twelve new Kinemetrics K2 strong motion seismographs. These instruments were provided under the urban strong motion component of the USGS FY 2001 Advanced National Seismic Network initiative. Siting and site installation planning was started

early in the reporting period, so that construction could begin in the early summer. Of the twelve instruments, eight were installed in the Reno-Carson urban corridor and four were installed in Las Vegas. All were installed and operating in at least triggered mode by the end of the federal fiscal year. In order to avoid continuing line charges we installed BreezeCom IP 2.4 Ghz IP or 900 MHz Freewave radio telemetry for all of the Reno area stations. Engineering and permitting is in progress to extend the radio network into the Carson Valley, approximately 30 km south of Reno. Two of the Las Vegas area instruments are presently being received directly over the Internet, and a third is expected to come on line shortly. Internet access approval was withdrawn at the fourth Las Vegas station, requiring us to explore other telemetry options.

Figure 2. The Nevada Seismological Laboratory established more than a dozen new strong-motion seismic monitoring stations during 2001 in the Reno (left), Carson City (center), and Las Vegas metro (right) areas. Equipment was provided by the USGS under the ANSS and FEMA grants. The red points on the maps are the new ANSS stations; brown points are other strong-motion stations. Images above are linked to large images.

Real-time data is presently recorded at six stations directly into to the Antelope Real-Time system used for the rest of the seismic network. As a promising indication of network sensitivity, a Ml 1.5 earthquake September 16, 2001 was observable at just above background noise levels by three of the Reno strong-motion sites. While the Reno area ANSS instruments were not yet deployed for the August 10, 2001 Portola earthquake, other strong-motion instruments did record the event. They showed that shaking is amplified by a factor of 3 to 5 in west Reno compared to nearby rock sites. Details about the NSL ANSS implementation are available at *www.seismo.unr.edu*. Siting and telemetry engineering for anticipated FY2002 instruments has already begun, with the hope that more forehanded planning will permit more efficient work when the time comes.

SUMMARY

Over 6950 earthquakes were located in the course of Western Great Basin Seismic Network operations in FY 2001. The largest within the network, (Ml 5.3) occurred west of Portola, California on August 10, 2001. The urban monitoring component of the ANSS initiative provided twelve new strong-motion instruments, eight of which were installed in the Reno-Carson urban corridor, and four in the Las Vegas Valley. Four additional strong-motion instruments were also installed two each in Las Vegas and Reno. Strong-motion records in Reno show that peak accelerations vary by a factor of 3 to 5 between valley and rock sites.