SEISMIC NETWORK OPERATIONS ALONG THE WASATCH FRONT URBAN CORRIDOR AND ADJACENT INTERMOUNTAIN SEISMIC BELT

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Technical Abstract

This cooperative agreement partially supports the operation of the University of Utah's 100-station telemetered regional seismic network. USGS support focuses on the seismically hazardous Wasatch Front urban corridor of north-central Utah but also encompasses neighboring areas of the Intermountain Seismic Belt. Primary products of this USGS support are quarterly bulletins, periodic earthquake catalogs, and the services of a regional earthquake-recording and information center.

This report covers the time period from January 1 through December 31, 1999. During the report period, we detected and analyzed approximately 9306 seismic events, including local earthquakes, teleseismic and regional earthquakes, and blasts. A total of 5225 earthquakes were located in the Intermountain Seismic Belt--including 1763 within the Utah region, of which 1183 were within the Wasatch Front region. Fifty-two earthquakes of magnitude 3.0 and larger occurred in the Utah region during the report period. The largest seismic event was one of M_L 4.2 that occurred on October 22, 1999, approximately 23 km ESE of Minersville, Utah.

In addition to fulfilling responsibilities for routine network operations and earthquake data processing, accomplishments during the report period included: (1) ensuring Year 2000 performance of all critical network systems; (2) advancing network capabilities towards real-time seismic monitoring and information flow; (3) completing a database of instrument responses needed for archiving our 19-year inventory of digital waveforms in standard SEED format; (4) in-situ calibration of recently-installed broadband digital telemetry stations; and (5) improving the quality of our earthquake catalog and other information products.

Specific efforts included:

- For Year 2000 compliance, implementation of needed changes to all network-related computer systems and equipment, including required operating system upgrades of all computers, subsequent testing of those systems, and revision of non-compliant earthquake-analysis software.

- Installation of Earthworm real-time-alert software system version 4.0 (Year 2000 compliant), submission of two new software modules (to continuously record waveform data in SAC format) to Earthworm Central for community-wide distribution, installation and use of a second Earthworm system for local testing purposes, continued work on tuning Earthworm automatic earthquake location software for optimized use with Utah data, and installation of new REF TEK digital telemetry software, replacing CPU-intensive software previously used.

- Completion of software to integrate regional digital telemetry data streams (6 Univ. of Utah REF TEK stations and 7 USNSN stations) with existing analog telemetry data streams for routine analysis, including real-time data exchange with the National Earthquake Information Center.

- In-situ calibration of all six Univ. of Utah three-component broadband digital telemetry stations and two USNSN stations using software we developed during the report period

- Installation and configuration (with the assistance of F. Vernon and J. Eakins, Univ. California, San Diego) of the Antelope real-time data acquisition and information system, cooperatively developed by Kinemetrics and Boulder Real-time Technologies.

- Completion of preparatory work for submitting 19 years of Univ. of Utah regional network waveform data to the IRIS Data Management Center in SEED format, including (1) software development to automatically convert Utah waveform data to SEED format for submission to the IRIS Data Management Center, (2) compilation of a database inventory of instrument components for all stations in our network since digital recording began in 1981 (this task proved to be greatly time consuming because all the required information had to be researched from handwritten field notes for more than 150 stations), and (3) use of this database to compute system response information for all past and present stations in our network (more than 700 individual instrument response calculations).

- Determination of local magnitudes (M_L) and M_L station corrections using synthetic Wood-Anderson seismograms from local USNSN and Utah broadband stations, for most

coda magnitude (M_C) 2.5 and greater earthquakes located in the Utah region since January 1, 1994 (project involved the analysis of more than 3100 earthquakes in the Inter-mountain seismic belt, and analysis to determine the validity of Richter's distance corrections for the study area).

- Detailed study of inadvertent temporal changes in the Utah coda magnitude scale, based on comparison with the new M_L data;

- Automated submission of earthquake catalog data for the Utah region several times per day to the CNSS composite catalog.

- Major efforts towards of an upgrade of our Web pages (URL: www.quake.utah.edu), to include (1) USGS seismicity map presentation format, (2) providing seismic data to GIS users in Arc/Info native format, and (3) complete reorganization of pages to make them more user friendly;

- Completion of software to convert data from Kinemetrics K2 strong motion accelerographs into SAC format for determining peak ground motions and for other signal processing.

- Near-completion of a comprehensive station inventory for the IASPEI handbook.

- Collaborative research with Max Wyss, University of Alaska, on statistical studies of the University of Utah's earthquake catalog, including space-time investigations of (1) homogeneity of magnitude reporting, (2) thresholds of complete recording, and (3) variations in frequency-magnitude distributions;

- Earthquake-awareness project (in partnership with the Utah Division of Comprehensive Emergency Management and the Utah State PTA) involving the display of an award-winning graphical exhibit, "Inter-mountain West Earthquakes," at dozens of elementary, junior-high, and high schools, and at other community sites throughout Utah;

- Studies of extensive coal-mining-induced seismicity in east-central Utah to serve the needs of (1) mining engineers and mine operators concerned with mine safety and (2) decision-makers dealing with the potential hazards of the mining seismicity to off-site structures and facilities;

- And continued systematic upgrade of aging field hardware and electronics in our analog short-period network (virtually all of our analog network now has standardized electronics and reconditioned sensors).

Non-technical Summary

January 1 - December 31, 1999

Under this cooperative agreement, the University of Utah receives partial support to maintain and operate a 100-station regional seismic network--as well as a regional earthquake information center--with emphasis on the seismically hazardous Wasatch Front urban corridor of north-central Utah. During the report period, of 9306 seismic events recorded and analyzed, a total of 1763 earthquakes were located in the Utah study region, including 52 shocks of magnitude 3.0 and larger. Notable project efforts related to ensuring Year 2000 performance of all critical network systems, advancing our capability for rapid earthquake alert, and improving the quality of data/information provided to the public and to national archives.