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Utah's Regional/Urban ANSS Seismic Network—Integrated Multifaceted Monitoring

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The University of Utah Seismograph Stations (UUSS, www.seis.utah.edu) is a research, educational, and public-service entity within the University's Department of Geology and Geophysics in Salt Lake City, Utah, USA. Primarily with state and federal support, UUSS operates a multifaceted regional and urban seismic network (37 deg – 45 deg N, 109 deg – 114 deg W) centered on the Intermountain Seismic Belt. The station density is highest within Utah's Wasatch Front urban corridor, which includes more than 75 percent of Utah's 2.8-million population as well as the major Wasatch normal fault. Regional seismic monitoring also includes a local focus on Yellowstone National Park in northwestern Wyoming and monitoring of abundant coal-mining-induced seismicity in east-central Utah. UUSS currently operates and maintains 208 seismic stations and records data from 250 stations: 49 broadband, 99 strong-motion, 102 short-period. Permanent GPS networks (operated and maintained by others) and nine infrasound arrays (operated by UUSS) complement the seismic monitoring throughout much of our regional network footprint.

Since 2000, our regional/urban seismic network has been a model for locally implementing the Advanced National Seismic System (ANSS) because of successes in integrating weak- and strong-motion recording and in developing an effective real-time earthquake information system in partnership with the U.S. Geological Survey (USGS). Early achievements included implementing ShakeMap, point-to-multipoint digital telemetry, an Earthworm Oracle database, in-situ calibration of all broadband and strong-motion stations, and the submission of all data and metadata to the Incorporated Research Institutions for Seismology (IRIS) Data Management Center. Our experience as a medium-size regional network affirms the fundamental importance of basics such as: (1) attention to high-quality field installations, signal quality, and computer operations; (2) a consistent focus on professional project management and human resources for operational efficiency; and (3) healthy partnerships to serve user needs. Some of our network improvements have been guided by feedback from emergency managers, engineers, public policy-makers, and other stakeholders as part of an active state earthquake program.

By the end of 2011, more than 65 stations will have been added to our network or upgraded since 2006. Along with this network expansion, we have made major efforts to redesign our network telemetry and data acquisition—both for efficiency and to ensure continuity of operations as part of a strategic plan with the USGS National Earthquake Information Center (NEIC). Our seismic network data are now transmitted to six remote Earthworm nodes dispersed throughout Utah. Data from legacy analog-telemetry stations are digitized at mountaintop collection points before transmission to the Earthworm nodes. Data from the nodes are then sent both to the University of Utah campus and to a redundant recording site $\sim$200 km south at a state facility in Richfield, Utah.

Software tools that we rely on for data acquisition and analysis include those developed by UUSS and by other organizations such as USGS (Earthworm), University of Washington (interactive data analysis software), Instrumental Software Technologies, Inc. (SeisNetWatch), and IRIS (PDCC for instrument responses and BUD tools for quality control). One of the main challenges we faced was the availability of a complete and coherent set of data-processing tools to achieve the performance requirements set forth by ANSS. Currently, we are integrating the standardized and supported software of the ANSS Quake Monitoring System (AQMS) into our network operations.