Partial Support of Joint USGS-CALTECH Southern California Seismographic Network

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Program Element: Seismic Networks

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INVESTIGATIONS

This Cooperative Agreement provides partial support for the joint USGS-Caltech Southern California Seismographic Network. The purpose is to record and analyze data from more than 23,361 local earthquakes from October 1999 to September 2000 and generate a database of phase data and digital seismograms. The primary product derived from the database is a joint USGS-Caltech catalog of earthquakes in the southern California region. The upgrade of the network instrumentation from analog to digital also continues. We also provide rapid response to emergency services, the media, and public inquiries about earthquakes.

For more detailed information about data access, please contact:
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RESULTS

Network Operation

Southern California Seismographic Network. The SCSN has 295 remote sites (with 1100 components) and gathers data from local, regional and teleseismic earthquakes. These data are used for earthquake hazards reduction as well as for basic scientific research. The earthquake hazards reduction effort has become more important as moderate-sized earthquakes continue to occur within densely populated areas in southern California. The largest earthquake to occur was the 16 October 1999 Mw7.1 Hector Mine earthquake in eastern California (Figure 1).

The average rate of 15 publications per year over the last 10 years using the network data illustrates the strength of the ongoing research activities that use the network data. Continued efforts to improve data quality and accessibility have created arguably the best regional earthquake database in the world. The ongoing upgrading of the quality of the waveforms recorded by the short-period network and the addition of low-gain seismometers and accelerometers provide numerous new avenues of research. Most important of these is analysis of on-scale waveforms to determine source, path, and site effects.

The USGS operates most of the remote stations in the SCSN. Jointly Caltech and USGS operate 125 broadband and strong motion and 30 strong motion TriNet stations (Figure 2). Caltech also maintains drum recorders and other equipment at the central site located in the Seismological Laboratory at Caltech.

The SCSN analog data are recorded by two microVAX-III computers and the data processing is done on six VAX workstations using a VAX-4000 as a central server. The TriNet data are recorded by two SUN/UNIX servers and processing is done using 15 SUN workstations. Caltech and USGS personnel share the operation of this equipment. To avoid duplication, software development is done in cooperation with the USGS in Menlo Park.

A total of 23,361 earthquakes were entered into the southern California earthquake catalog for this reporting period. Approximately 10.0-15.0 Mbytes of phase data and 75-150 Gbytes of seismograms were archived. In addition to the data analysis we carry out software maintenance, hardware maintenance, and other tasks necessary to complete the catalog. Caltech and USGS maintain a data base that includes: 1) earthquake catalog (1932-present); 2) phase data (1932-present); 3) photographic paper seismograms (1930-1992); and 4) digital seismograms (1977-present). The earthquake catalog (1932-present) and phase data (1932-present) are available over the Internet. Other data are available upon request. This data base has been made available to the SCEDC and is the most voluminous part of the data stored in the SCEDC.

Near real-time reporting to USGS in Reston and the Governor's Office of Emergency Services and other response to any felt or damaging earthquake activity is provided by network personnel.

The Southern California Earthquake Data Center. This center has significantly increased the use of the data from SCSN for scientific research. The mass-store system, which became operational on 1 October 1991, provides on-line storage for more than 1000 Gbytes of data. The availability of 60 years of catalog, 60 years of phase data, and 15 years of digital seismograms on both UNIX and VMS computers and on-line over INTERNET/NSFNET improves the access to the data.

SEISMICITY SUMMARY FOR SOUTHERN CALIFORNIA
October 1999 - September 2000

Southern California seismic activity for the 12-month period from October 1, 1999 through September 30, 2000 consisted of 23,361 earthquakes recorded and located by the Southern California Seismic Network. 876 of these earthquakes had a magnitude of 3.0 or larger, 76 were M4.0 or larger, and five, including the Hector Mine mainshock, were M5.0 or larger. In addition to the earthquakes, there were 839 mine and quarry blasts recorded.

The most outstanding earthquake was the Mw7.1 Hector Mine earthquake, which occurred at 0946 UTC on October 16, 1999. Most of the year's activity, 12,034 total events processed so far, consisted of aftershocks to this Hector Mine quake. Data processing for the aftershocks above M2.5 in October 1999, and all of the subsequent aftershocks, has been completed; there are about 1,095 of the smaller events yet to process.

For the mainshock, right-lateral strike-slip faulting was observed on the grounds of the Twentynine Palms Marine Base. Due to the earthquake's remote location, the disaster that one would expect from a Mw7+ earthquake in California was never forthcoming.

The Landers aftershock sequence, of the June 28, 1992 Mw7.3 Landers earthquake, was also represented with 1,113 earthquakes. By contrast, the aftershock sequence of the January 17, 1994 Mw6.7 Northridge quake is hardly represented at all: a total of 265 events total.

Most of the rest of the seismicity was very ordinary. The Coso Range and southern Owens Valley areas had a small share of the activity, include a ML4.2 on February 28, a ML4.1 on February 29, these both in the Coso Range 19 miles east of Coso Junction, and a ML4.3 on March 28, 4 miles east-southeast of Coso Junction. A pair of ML4+ quakes, a ML4.2 and a ML4.5 occurred on June 14, 2000, in the Imperial Valley 5 miles south-southeast of Brawley.

Processing of Backlog of SCSN Data

The work load of Hector Mine aftershocks prevented substantial progress on processing earlier backlogs. We still have data from 1983, and from 1980 and 1981, which need to be picked and located. Data recorded on the CEDAR system (a previous real-time recording and post-processing system) are being translated into CUSP format and archived on the SCEC Data Center, for future review. Hand phase picks, previously entered into the computer, from the 1950's and the 1970's, are being used to relocate and reassign magnitudes to historical earthquakes in the region.

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Southern California

Seismicity October 1999 -- September 2000

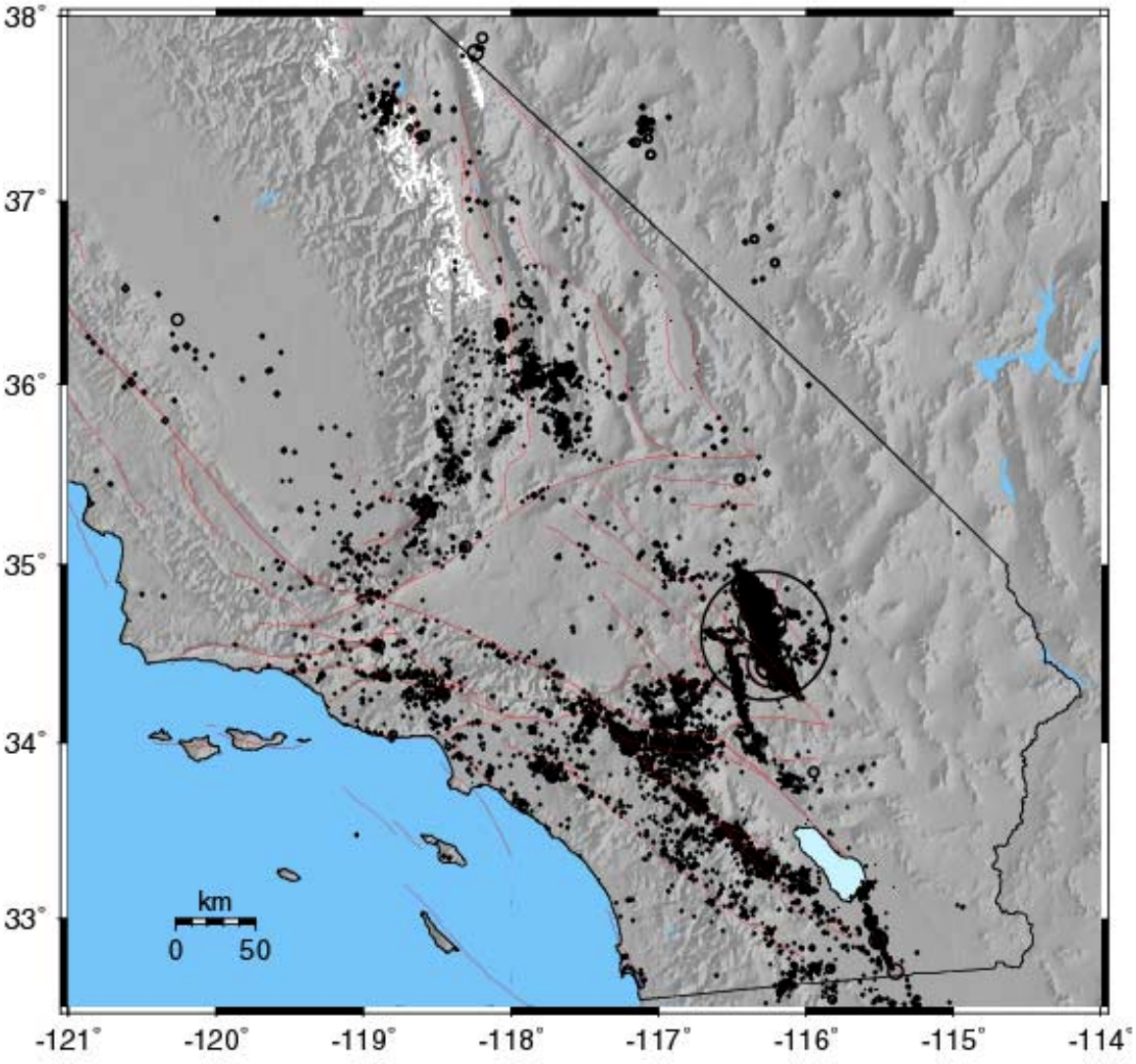

Figure 1. Earthquakes recorded by SCSN/TriNet.

Caltech-USGS TriNet

Current/Planned Configuration 2000

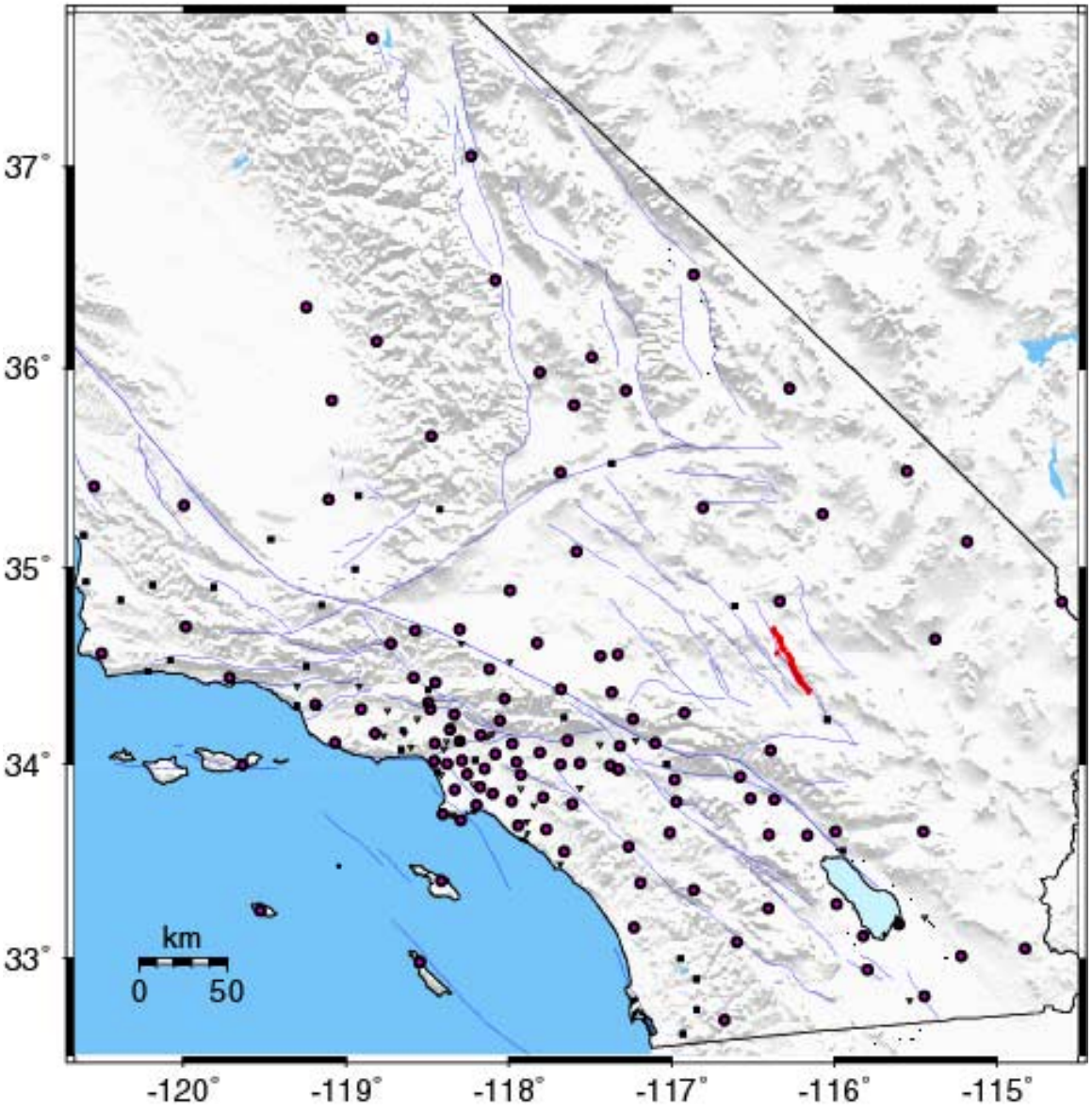

Fig. 2. TriNet digital broadband and strong motion (circles) seismic stations, strong motion stations (triangles), and planned stations (squares).

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NON-TECHNICAL SUMMARY