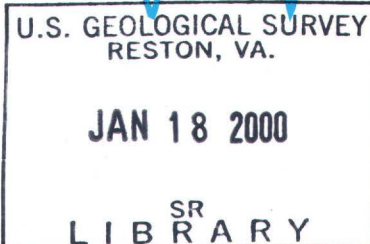


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# Seismograms Live from around the World

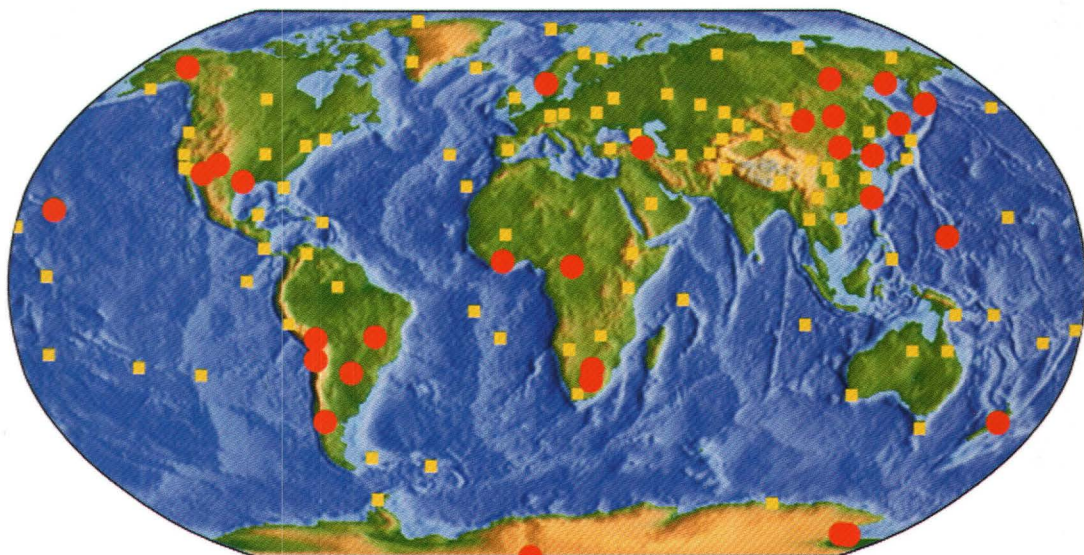


**You can view earthquakes as they happen! Seismograms from seismic stations around the world are broadcast live, via the Internet, and are updated every 30 minutes. With an Internet connection and a web browser, you can view current seismograms and earthquake locations on your own computer. With special software, also available via the Internet, you can obtain seismic data as it arrives from a global network of seismograph stations.**

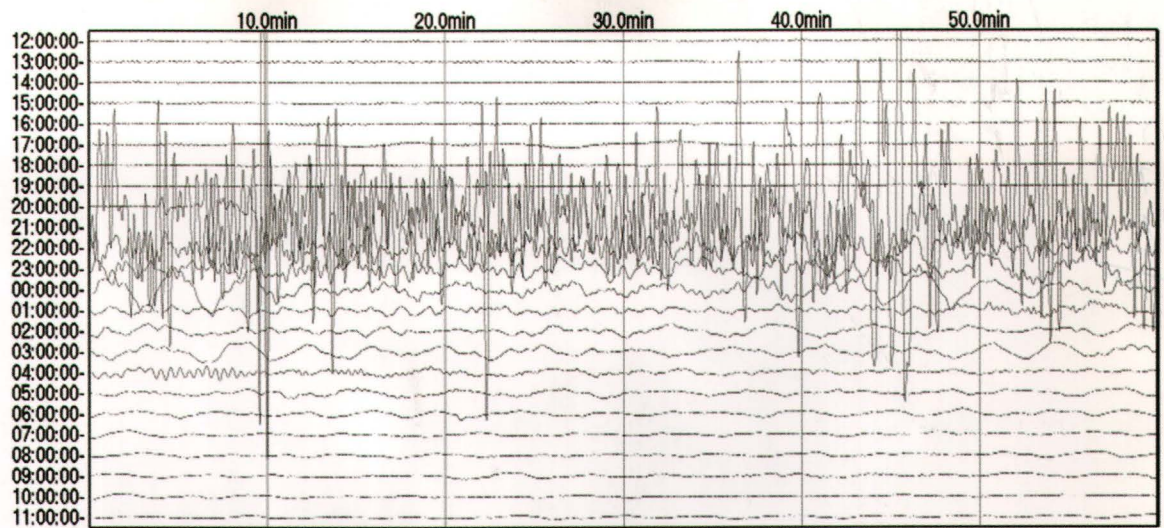
## The Global Seismograph Network

The Albuquerque Seismological Laboratory (ASL) of the United States Geological Survey (USGS) broadcasts digital seismic data (seismograms) in near real time via the Internet. These digital seismograms are presented in the familiar style that you have seen on television, in newspapers and magazines, and at the top of this Fact Sheet. This familiar seismogram is created by a pen swinging back and forth across a sheet of paper wrapped around a cylinder. Scientists use the arrival times of different waves on seismograms, the seismic station locations, and knowledge of the structure of the Earth to calculate the earthquake

epicenter and magnitude. The Global Seismograph Network (GSN), a collaborative effort between the USGS, the University of California at San Diego (UCSD), the National Science Foundation (NSF), and the Incorporated Research Institutes for Seismology (IRIS), currently operates 115 stations around the world. The seismograms from GSN stations are used for a variety of purposes, including earthquake reporting, tsunami warning, and nuclear test monitoring. At present, seismograms from more than 30 of the GSN stations maintained by the USGS are available via the Internet.



- Internet capable (LISS) GSN stations (30)
- Standard GSN stations (88)



## Web Surfing for Live Seismograms

Live GSN earthquake records may be downloaded to your computer via the Live Internet Seismic Server (LISS). The most recent 24-hour seismogram from each available real-time station is online at the LISS website. In addition, the LISS website reports the locations of earthquakes that have occurred in the past 24 hours, using information supplied by the National Earthquake Information Service (NEIS). The GSN seismograms and the NEIS earthquake-location plots are updated every 30 minutes.

## The Technical Side: How the LISS Works

The LISS receives seismograms from individual GSN seismograph stations all over the world. Most of these seismograms are a type of record called broadband waveform data. This means that the seismic station records ground motion information at all frequencies of interest to scientists. Typical GSN broadband seismic data records contain 30 seconds of data, sampled 20 times per second, for a total record length of 600 data points. Each station sends a new data record to the LISS every 30 seconds. When a record is received at a station, LISS computers 'connect' it to the previously received record from the same station, and 'build' a continuous 24-hour seismic record. The seismograms displayed on the website are made of 1-sample-per-second data derived from the 20-sample-per-second data.

LISS's can be run in a chain, in which one LISS exchanges data with another. In this way, LISS's can be placed at different locations on the Internet to provide redundant paths for data access and transmission. At present, auxiliary LISS's running in Moscow, Russia, Beijing, China, and the University of Texas at Austin, are exchanging data

with the LISS at the USGS/ASL. As each LISS receives a record, it duplicates the record and sends copies of it to the other three LISS's. This redundancy ensures that no data are lost and that all interested clients are able to access LISS data.

## Extra for Experts: Making a Direct Connection to the LISS

Organizations that need to see data quickly, such as the National Earthquake Information Center and tsunami warning centers, have near-real-time connections to the LISS. However, the LISS data distribution system can support any number of simultaneous Internet connections. This means that the LISS is available to anyone with the necessary skill and software. At present, LISS communication is one-way: you connect to the LISS via the Internet and start receiving records. In the next-generation LISS we plan to implement a simple command language, enabling you to query the LISS and customize the data you wish to receive.

LISS data are transmitted in fixed-length records of 256 or 512 bytes (depending on the station). Stations are described by their internationally recognized network code and station call letters. The data records are in the internationally recognized Standard for the Exchange of Earthquake Data (SEED) format. Each record has a fixed header and contains compressed data. The USGS/ASL has UNIX-based distribution software that shows how to connect to the LISS and unpack the data records, producing a simple ASCII output. Software, more complete information and instructions, and station information may be found at the LISS website (see column at left for the URL).

Robert L. Woodward, Kaye M. Shedlock, and Harold F. Bolton

### LISS

<http://www.liss.org>

### National Earthquake Information Center:

<http://earthquake.cr.usgs.gov>

### USGS home page:

<http://www.usgs.gov>