Did You Feel It?
Citizens Contribute to Earthquake Science

Since the early 1990s, the magnitude and location of an earthquake have been available within minutes on the Internet. Now, as a result of work by the U.S. Geological Survey and with the cooperation of various regional seismic networks, people who experience an earthquake can go online and share information about its effects to help create a map of shaking intensities and damage. Such "Community Internet Intensity Maps" (CIIMs) contribute greatly toward the quick assessment of the scope of an earthquake emergency and provide valuable data for earthquake research.

Then and Now

Not so long ago, the first thing that most people did after feeling an earthquake was to turn on their radio for information. That practice is changing, however. After the 2003 San Simeon earthquake in central California, for example, many people logged onto the Internet, not only to get information, but also to share their own experience of the earthquake. After checking the U.S. Geological Survey (USGS) Web site for the location and magnitude of the earthquake, they went to a Web page called "Did You Feel It?" (at *http://earthquake.usgs.gov/*). They entered their ZIP Code and answered a list of questions such as "Did the earthquake wake you up?" and "Did objects fall off shelves?" In minutes a map began taking shape on the Internet, and in a few hours, with more than 14,000 responses for the central California event, a Community Internet Intensity Map (CIIM) showed where and how strongly the earthquake had been felt and where damage occurred.

Macroseismic Intensity

Macroseismic intensity describes the strength of shaking from an earthquake at a particular location, as determined from effects that people can readily observe without special instruments or special training. Such macroseismic effects include damage caused by the earthquake and the strength of shaking as perceived by people.

In general, the macroseismic intensity is highest near the earthquake source and decreases with distance from the source. However, a variety of factors—such as the direction in which the earthquake fault ruptures and variations in the soil conditions underlying different sites—may lead to complicated patterns of intensities that vary strongly from place to place.

Since 1931, the USGS has assigned macroscopic intensities to United States earthquakes on the basis of the Modified Mercalli Intensity (MMI) scale. Until recently, most of the macroseismic observations used to assign intensities were collected with questionnaires that were mailed to post offices in the earthquake region. The process of sending the questionnaires by standard mail, waiting for written responses, manually interpreting the responses, and preparing intensity maps could take months. In the late 1990s, the USGS began collecting data and publishing CIIMs on the "Did You Feel It?" Web page.

Community Internet Intensity Maps

In contrast to the intensity maps prepared from paper-copy questionnaires, CIIMs take advantage of the Internet to generate intensity maps almost instantly. Data are received through questionnaires on the Internet answered by people who experienced the earthquake. The Internet approach reduces the time for preparing and distributing a shaking-intensity map from months to minutes.

A CIIM summarizes the responses. An intensity number is assigned to each ZIP Code for which one or more CIIM questionnaires are completed. The intensity values in each ZIP-Code area are averaged, and the map is updated as additional data are received. ZIP-Code areas for which data have been received are color-coded according to the intensity scale shown below the map on the CIIM Web page; other areas are gray.

A CIIM is automatically made after each widely felt earthquake in the United States. The system can start receiving responses immediately after the earthquake. Internet users can also enter data for significant U.S. earthquakes they have experienced in the past.

The CIIM procedure was constructed so that CIIM intensities would agree on average with MMI values produced by the traditional procedure that is based on postal questionnaires. For some specific levels of shaking, differences are likely between intensities produced by the two procedures, just because the procedures are different. Five years' experience with the CIIM procedure, however, has shown that the CIIM values usually agree well with MMI values that would be assigned by the traditional procedure. In cases where the new CIIM methodology produces values that differ from those produced by the traditional procedure, the CIIM values are usually more self-consistent, because they are usually based on many more observations in a given ZIP Code.

A Unique Tool for Understanding Earthquakes

In areas such as California where there are networks of seismic instruments, CIIMs provide a very rapid means of displaying the pattern of shaking *independent* of strong-motion seismographs. CIIMs provide descriptions of actual damage, rather than inferred damage indicated by instrumental shaking records. Also, the potential number of Internet responses far exceeds the number of seismic instruments, so very dense sampling of earthquake effects is possible, providing details that would not be possible with the instruments alone.

In regions with few seismic instruments, which includes most of the United States and most of the World, intensity observations for a small to moderate event can indicate which areas will be more prone to shaking in larger, but less frequent earthquakes. After a damaging earthquake in those sparsely instrumented areas, CIIMs can provide information about which areas experienced the most shaking and, therefore, the most potential damage. This information can serve not only as a tool for postearthquake response, but also for estimating losses from future earthquakes.

The interactive nature of the Internet questionnaire and mapping provides an unprecedented opportunity for community involvement. The CIIM interactive Web site provides an avenue for feedback among the communities affected by earthquakes, scientists studying earthquake effects, and agencies responding to the events. By allowing people in an area struck by an earthquake to share their experiences, the CIIM Web site may help them cope with the emotional impact of the earthquake.

Typical Effects of Different Intensity Levels.

[Most of the effects are sometimes observed in special circumstances at lower intensities than suggested by the table. Some of the effects are used to help define intensity levels in the CIIM procedure; other effects do not influence calculation of intensity values, but are nonetheless commonly observed]

I. Not felt. Changes in level and clarity of well water are occasionally associated with great earthquakes at distances beyond which the earthquake is felt by people. II. Felt by a few. Delicately suspended objects may swing. III. Felt by several; vibration like passing of truck. Hanging objects may swing appreciably. IV. Felt by many; sensation like heavy body striking building. Dishes rattle. Walls creak; windows rattle. V. Felt by nearly all; frightens a few. Pictures swing out of place; small objects move; a few objects fall from shelves within the community. A few instances of cracked plaster and cracked windows within the community. Trees and bushes shaken noticeably. VI. Frightens many; people move unsteadily. Many objects fall from shelves within the community. A few instances of fallen plaster, broken windows, and damaged chimneys within the community. Some fall of tree limbs and tops, isolated rockfalls and landslides, and isolated liquefaction. VII. Frightens most; some lose balance. Heavy furniture overturned. Damage negligible in buildings of good design and construction, but considerable in some poorly built or badly designed structures; weak chimneys broken at roof line, fall of unbraced parapets. Tree damage, rockfalls, landslides, and liquefaction are more severe and widespread with increasing intensity. VIII. Many find it difficult to stand. Very heavy furniture moves conspicuously. Damage slight in buildings designed to be earthquake resistant, but severe in some poorly built structures. Widespread fall of chimneys and monuments. IX. Some forcibly thrown to the ground. Damage considerable in some buildings designed to be earthquake resistant; buildings shift off foundations if not bolted to them. X Most ordinary masonry structures collapse; damage moderate to severe in many buildings designed to be earthquake resistant.

For More Information:

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