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Sensing a Vibe: Seismic-alert system could give Los Angeles a few seconds' warning

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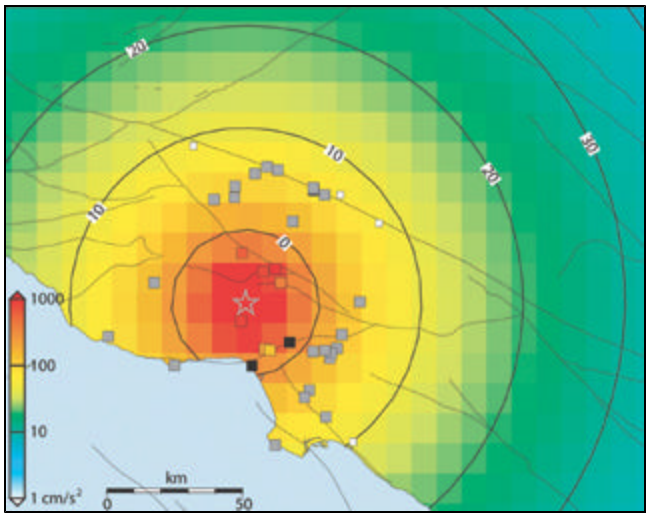
A sprawling network of seismometers that covers the Los Angeles area could be adapted to provide warning of damaging ground motions from earthquakes in the seconds before those seismic vibes arrive, according to a new analysis.



WHOLE LOTTA SHAKIN'. A warning system could predict ground motions from an ongoing quake. This map depicts predicted peak ground accelerations (color scale) in Southern California as if estimated 10 seconds after the 1994 Northridge quake began. Numbers in white boxes indicate warning time in seconds until arrival of peak ground motion.
Allen

Some other quake-prone regions already have early-warning systems. For example, seismic instruments about 300 kilometers southwest of Mexico City detect the vibrations spreading from large temblors that occur even farther to the southwest. That gives residents in the metropolitan area about 70 seconds' warning.

Could an alert system work in cities, such as Los Angeles, that

rest right on top of active fault zones? Most parts of even those at-risk areas could receive a few seconds' warning, says Richard M. Allen, a seismologist at the University of Wisconsin–Madison.

Earthquakes create several different types of seismic vibrations. The waves that travel most quickly through Earth's crust—the so-called P waves—are similar to sound waves, and they push and pull the ground in the direction of the waves' trajectory. These waves don't typically cause damage to buildings or other structures because of their high frequency and small magnitude, says Allen. However, these vanguard vibrations contain information that scientists can use to predict the size of the more dangerous S waves that follow. Those shudders, which shake the ground from side to side at low frequencies, travel at about half the speed of the P waves.

Allen and his colleague Hiroo Kanamori of the California Institute of Technology in Pasadena studied the ground motions for the 53 earthquakes with Richter scale magnitudes above 5.0 that have occurred in the Los Angeles area since 1995. The pair found that they could reasonably predict the magnitude of an earthquake's yet-to-arrive S waves by looking at the first second of P waves detected by a seismometer. The best estimates needed only 4 seconds' seismic data, Allen and Kanamori report in the May 2 *Science*.

A warning system that pulled data from the existing network of seismometers around Los Angeles and performed similar analyses in real time could provide at least some residents with a few moments' warning—possibly by way of sirens or the Internet—of the shaking to come. For example, at locations 60 km from a temblor's epicenter, the magnitude of an impending quake could be known about 16 seconds ahead of time.

That may not sound like much time, but it could avert some catastrophes, says Allen. Utility companies might be able to turn off pipelines, manufacturers could shut down the flow of toxic chemicals, and trains could be automatically slowed or stopped before the most damaging ground motions occurred. Also, rescue workers digging through unstable rubble in the wake of a major quake could be warned of aftershocks that are on their way.

One particularly valuable application might be to minimize casualties by having school children dive under their desks, says John R. Filson, manager of the U.S. Geological Survey's earthquake hazards program in Reston, Va.

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Further Readings:

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