Large earthquakes may broadcast warnings, but is anyone tuning in to listen?

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Like geological ninjas, earthquakes can strike without warning. But there may be a way to detect the footfalls of large earthquakes before they strike, alerting their potential victims a week or more in advance. A Stanford professor thinks a method to provide just such warnings may have been buried in the scientific literature for over 40 years.

In October, Japan instituted a nationwide earthquake warning system that heralds the advance of a big earthquake; its sophisticated machinery senses the shaking deep in the earth and transmits a warning signal that can beat the tremors to the surface by seconds.

Antony Fraser-Smith, professor emeritus of electrical engineering and of geophysics, has evidence that big temblors emit a burst of ultra-low-frequency electromagnetic radio waves days or even weeks before they hit. The problem is that nobody is paying enough attention.

Fraser-Smith has been interested in electromagnetic signals for decades. Most of these waves come from space, he said, generated in the upper atmosphere by the sun and then beamed down to Earth.

In 1989, Fraser-Smith and his research team were monitoring ultra-low-frequency radio waves in a remote location in the Santa Cruz Mountains as part of a long-term study of the signals reaching Earth from space. On Oct. 5, 1989, their equipment suddenly reported a large signal, and the signal stayed up for the next 12 days. At 2:00 p.m. on Oct. 17, 1989, the signal jumped even higher, about 20 to 30 times higher than what the

instruments would normally ever measure, Fraser-Smith said. At 5:04 p.m. the 7.1 magnitude Loma Prieta earthquake hit the Monterey Bay and San Francisco Bay areas, killing 63 people and causing severe damage across the region.

Fraser-Smith originally thought there was something wrong with the equipment. After ruling out the possibility of technical malfunctions, he and his research team started to think the Loma Prieta quake had quietly announced its impending arrival, and that their equipment just happened to be in the right place at the right time to pick up the message.

"Most scientists necessarily make measurements on small earthquakes because that's what occurs all the time," Fraser-Smith said. "To make a measurement on a large earthquake you have to be lucky, which we were."

Along with Stephen Park, earth sciences professor at the University of California-Riverside, and Frank Morrison, professor emeritus of earth and planetary science at UC-Berkeley, Fraser-Smith continued to study the phenomenon of earthquakes emitting electromagnetic waves through a study funded by the U.S. Geological Survey (USGS).

When the USGS terminated the funding in 1999, he decided to move on to other things. But he was recently drawn back into this issue by a local private company that wanted to use his methods to develop earthquake warning systems.

"I took a new look at the measurements, concentrating entirely on large earthquakes," Fraser-Smith said, "and all of a sudden I could see the forest through the trees."

He found three other studies describing electromagnetic surges before large earthquakes, just as he had found at the Loma Prieta site. The

earliest report was from the Great Alaska earthquake (M9.2) in 1964. Up until now, most of the focus for earthquake warnings and predictions has been on seismological studies, but no seismic measurements have ever shown this kind of warning before a big quake, Fraser-Smith said.

This technique will probably only yield results for earthquakes of approximately magnitude 7 or higher, because background waves from the atmosphere will tend to mask any smaller signals. But these are the quakes people are most concerned about anyway, from a safety and damage point of view.

Some seismologists are suspicious that these results are real, Fraser-Smith said. But it would take little effort to verify or disprove them. He is calling for federal funding for a mission-oriented study that would place approximately 30 of the ultra-low-frequency-detecting instruments around the world at hotspots for big quakes. It would cost around $3 million to buy 30 of these machines, he said, which is cheap compared to the cost of many other large studies.

Every year, there are on average 10 earthquakes of magnitude 7 or higher around the world. So within just a few years, he said, you could potentially have 10 new measurements of electromagnetic waves before big quakes-surely enough to determine whether the previous four findings were real.

Source: Stanford University