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NEWS

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Earthquake Warning System Sounds Alarm Seconds before Tremors Begin

Most seismologists agree that predicting earthquakes days in advance is not going to be possible anytime soon. But borrowing from a system developed in Japan, scientists have devised an early warning system that will alert southern California residents seconds before a temblor begins.

When an earthquake strikes, the first pulse of energy to radiate from the point of origin comprises primary (p) waves. P waves travel about two times as fast as the secondary (s) waves that follow them and that carry the destructive, ground-shaking power characteristic of large quakes. The s waves are traditionally used to assess the magnitude of an event, but this information is only gleaned after the fact. The new system measures the first waves to arrive – the p waves – and thus provides warnings up to tens of seconds before the ground begins to move. That might seem like a negligible amount of time, but it's enough to take cover beneath a table or shut off gas lines and water mains.

Richard Allen of the University of Wisconsin and Hiroo Kanamori of the California Institute of Technology describe the system, called ElarmS, today in the journal *Science.* They developed ElarmS using historical earthquake data collected by an array of sensors spread throughout southern California. Measuring the frequency content of the p waves allowed Allen and Kanamori to figure out what the damage potential from a given quake might be at any point in the region. The system works because smaller earthquakes tend to send out high-frequency p waves whereas large-magnitude events radiate lower frequency energy.

ElarmS is designed to detect earthquakes small and large, because "only if it works for small magnitude events can we be sure the system is operational," Allen says. "If we're only looking at magnitude-6 earthquakes we'd only be testing every 30 years or so, and that's not practical." Now those

seismologists that run southern California's already-established network of sensors, TriNet, are integrating Allen and Kanamori's computer program into their system. ElarmS will be tested using real-time data from small earthquakes over the coming years. Allen believes it will be most useful in developing safer automated transportation systems, buildings and city infrastructure that can be programmed to react to incoming p waves. "It is perhaps not reasonable to expect people to respond to an alarm they hear once every 30 years," he says, "but we have the potential now to build infrastructure that responds to these warnings and protects occupants." – *Laura Wright*

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