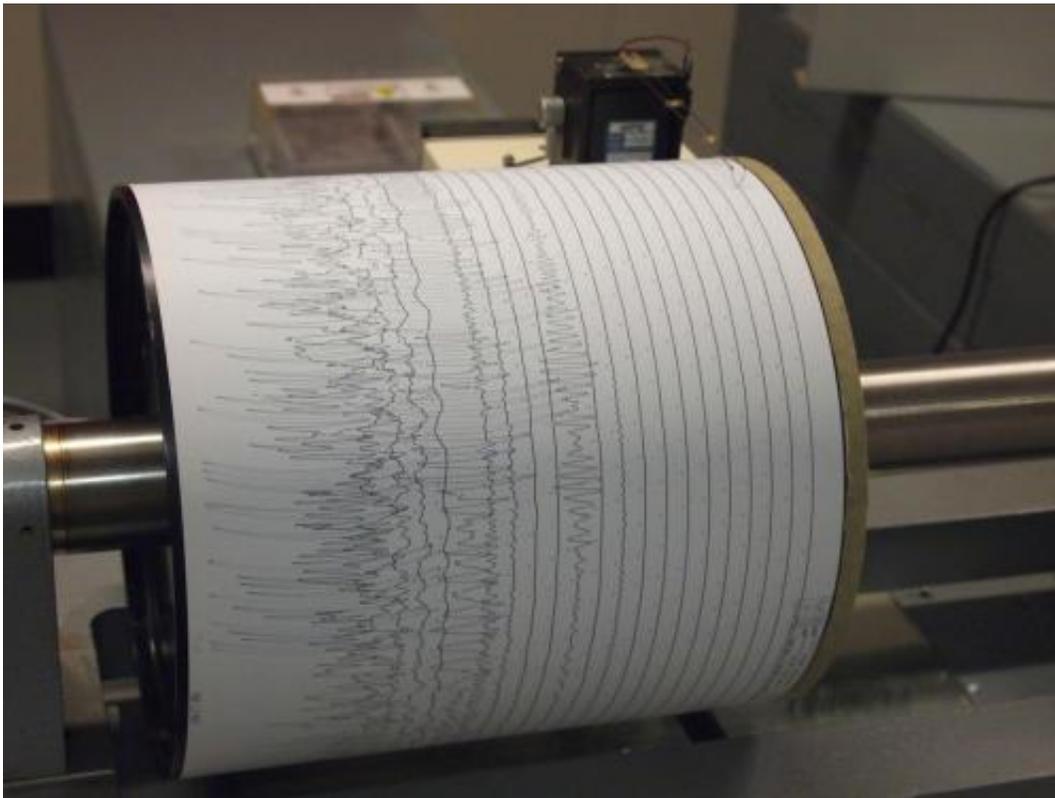


Fixed network of smartphones provides earthquake early warning in Costa Rica

April 20 2021



Seismogram being recorded by a seismograph at the Weston Observatory in Massachusetts, USA. Credit: Wikipedia

Earthquake early warnings can be delivered successfully using a small network of off-the-shelf smartphones attached to building baseboards, according to a study conducted in Costa Rica last year.

In his presentation at the Seismological Society of America (SSA)'s 2021 Annual Meeting, Ben Brooks of the U.S. Geological Survey said the ASTUTI (Alerta Sísmica Temprana Utilizando Teléfonos Inteligentes) [network](#) of more than 80 stations performed comparably to scientific-grade [warning](#) systems.

During six months' of ASTUTI operation, there were 13 earthquakes that caused noticeable shaking in Costa Rica, including in the city of San Jose where the network was deployed. The system was able to detect and alert on five of these earthquakes, Brooks and his colleagues determined when they "replayed" the seismic events to test their network.

Alerts for the system are triggered when shaking exceeds a certain threshold, equivalent to slightly less than what would be expected for a magnitude 5 earthquake, as measured by the accelerometers that are already built into the phones, Brooks said.

In simulations of the magnitude 7.6 Nicoya earthquake that took place in 2012 in Costa Rica, ASTUTI would have delivered its first alerts on average nine to 13 seconds after the event.

"The performance level over the six months is encouraging," Brooks said. "Cascadia events in the Pacific Northwest are similar to the Costa Rican subduction zone, and latencies for ShakeAlert in Cascadia are about 10 seconds, so it's comparable."

ASTUTI demonstrates the possibilities of lower-cost earthquake early warning for regions that lack the scientific-grade network stations such as those behind ShakeAlert, he noted.

"I would imagine that would be attractive for countries with less resources to dedicate to earthquake early warning" Brooks said, "but the performance is also at a level that I imagine would interest even

wealthier countries."

The accelerometers within smartphones are ideal for a low-cost network, Brooks and his colleagues suggested. "If you were to build your own sensors, there's a lot of cost in maintaining them, and the sensors will quickly become obsolete," Brooks said.

By using commercial technology, "we let the big telecommunications companies do the research and development and we just deploy it," he added.

The phones were deployed in the homes of researchers and staff at the Observatorio Vulcanologico y Sismologico de Costa Rica (OVSICORI). The phones were enclosed in a plastic protective box before being mounted to the baseboard with 3M adhesive tape. As a result, the phones sense an earthquake through the filter of the structures, rather than directly as is the case for buried seismometers.

During testing, the system did not issue any false alerts. The researchers' analysis suggests the system could deliver alerts to 15% to 75% of Costa Rica's population in enough time to carry out drop-cover-hold-on responses, if it alerted the entire country after detecting an earthquake.

Countrywide alerting might be a successful strategy for the network, since recent studies show that people tend to be more tolerant than previously suspected of receiving warnings even if they didn't feel shaking, especially if they live in hazard-prone regions such as Costa Rica, said Brooks.

The work was funded by the U.S. Agency for International Development Bureau for Humanitarian Assistance. Next steps for ASTUTI will be to develop an app to make it more user-friendly and to deploy it more widely throughout the country.

Low-cost networks like ASTUTI will be a growing trend in [earthquake early warning](#) over the next decade, Brooks predicted. "When your objective is warning, you don't necessarily need the fanciest equipment."

Provided by Seismological Society of America

Citation: Fixed network of smartphones provides earthquake early warning in Costa Rica (2021, April 20) retrieved 19 September 2024 from <https://phys.org/news/2021-04-network-smartphones-earthquake-early-costa.html>

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