Why Didn't the Seismic Alarm Sound before the Quake?

On September 7, 2017, at almost midnight, the seismic alarm sounded 124 seconds before an 8.2-magnitude quake was felt in Mexico City; its epicenter was in the Gulf of Tehuantepec, more than 600 kilometers away. However, on September 19, no alarm sounded before the quake. Therefore, people evacuated buildings when the ground was already shaking. The reason: this time the epicenter was "on the border between the states of Morelos and Puebla."[1]

According to the Center for Seismic Instrumentation and Registry (CIRES), on September 19, the alarm activated 20 seconds before the quake; however, the citizenry say that it sounded after the tremors started.

On September 28, CIRES corrected its statement to say that the alarm had not activated automatically and in advance because of the proximity of the epicenter and Mexico City. This means that the further away the epicenter, the more time there will be to alert the public.

According to CIRES, two kinds of waves are produced in an earthquake: P waves, which are rapid and do not cause as much damage, and S waves, which move more slowly and can be devastating. The CIRES system can identify both and activate the alert between 50 and 125 seconds before the S waves arrive to the capital.

On September 19, the P waves moved very quickly, but the Pilcaya and Tehuitzingo, Puebla sensors registered them with a 10-second delay. The system calculated the magnitude of the quake and communicated to Mexico City in three seconds (a calculation known as the 3S algorithm.). However, the sensors in Puebla cannot activate an alert with that algorithm; they must make a second calculation that takes longer and requires the registration of the S waves, which travel at half the speed of the P waves.

The calculation was made at the Pilcaya sensor, but it had to be confirmed by the other sensor. Seconds later, the Tehuitzingo sensor reported a quake of more than six on the scale. CIRES member Armando Cuéllar explained that there was a lag in the detection of the quake between the Pilcaya and Tehuitzingo sensors, with the latter calculating the magnitude of the quake seven seconds late.

The seismic alert system not only detects the movements in the earth, but also must ensure that the majority of the population can hear it. Many people have said that on September 7, the alarm did not sound. Some woke up when they felt their homes moving, implying that the siren was not loud enough to wake people up, or to get them to interrupt what they were doing, or to be heard by all the city's inhabitants.

After the September 19, 2017 11 a.m. drill, many people said that that they had not heard the alarm. On the afternoon of that same day, television and radio stations, which have an automatic system to interrupt programming and sound the alert, said they had not received the CIRES signal that sets off the alarm.

Seismologist Diego Melgar says that one of the challenges for Mexico's seismic alert is transmission, and that at least five or six media are needed to broadcast the signal, since one is insufficient. Those media could be radio, television, public loudspeakers, home equipment, and a cellular app. As an example, he mentions the California project he participates in where the seismic alert system produces alarms distributed by smartphone. In Mexico, cell phone apps like SkyAlert have begun to be created. Andrés Meira created an apparatus called "Grillo" (Cricket) that receives the CIRES radio signal, setting off an alarm and activating a "light alarm."[2] Today, technicians are working to create a "network of sensors" for Grillo and an app based on smartphone sensors. VM

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Notes

1 Information for this article was all taken from Sara Hidalgo and Andrés Lajous, "¿11 segundos más tarde? Los límites y obstáculos de la alerta sísmica en la Ciudad de México," *Nexos*, digital edition, November 1, 2017, https://www.nexos.com.mx/?p=34379.

2 See more about this alert at Pepe Pulido, "Grillo es una alerta sísmica que avisa hasta 90 segundos antes del siniestro," Código espagueti, September 19, 2017, https://codigoespagueti.com/noticias/tecnologia/grillo-alarma-sisimica-90-segundos/. [Editor's Note.]