World's largest subwoofer: Earthquakes 'pump' ground to produce infrasound

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Earthquakes sway buildings, buckle terrain, and rumble – both audibly and in infrasound, frequencies below the threshold of human hearing. New computer modeling by a team of researchers indicates that most of the low-frequency infrasound comes from an unexpected source: the actual "pumping" of the Earth's surface. The researchers confirmed their models by studying data from an actual earthquake.

"It's basically like a loudspeaker," said Stephen Arrowsmith, a researcher with the Geophysics Group at Los Alamos National Laboratory in Santa Fe, N.M., who presents his team's findings at the 164th meeting of the Acoustical Society of America (ASA), held Oct. 22 – 26 in Kansas City, Missouri. "In much the same way that a subwoofer vibrates air to create deep and thunderous base notes, earthquakes pump and vibrate the atmosphere producing sounds below the threshold of human hearing."

Infrasound can reveal important details about an earthquake. In particular, it may be used to measure the amount of ground shaking in the immediate region above the source, which would normally require an array of many seismometers to measure. There is therefore potential to use infrasound to assess damage in the immediate aftermath of an earthquake.

To better understand the relationship between earthquakes and infrasound, the researchers used the basic idea that the Earth's surface above the earthquake pumps the atmosphere like a piston. They were then able to apply the same modeling approach used on loudspeaker

dynamics.

The researchers tested their model by comparing its predictions to actual data collected from a magnitude 4.6-earthquake that occurred on January 3, 2011, in Circleville, Utah. The University of Utah maintains seismograph stations across the state supplemented with infrasound sensors, which recorded the infrasound produced during that event. Their predictions were in good agreement with the actual data, suggesting that earthquakes generate most of their sound by pumping the atmosphere like a loudspeaker.

"This was very exciting because it is the first such clear agreement in infrasound predictions from an earthquake," said Arrowsmith. "Predicting infrasound is complex because winds can distort the signal and our results also suggest we are getting better at correcting for wind effects."

Until now, seismologists have not understood the relative importance of the simple pumping of the ground versus other mechanisms for generating infrasound.

Additional members of the research team include Relu Burlacu and Kristine Pankow, University of Utah; Brian Stump and Chris Haward, Southern Methodist University; and Richard Stead and Rod Whitaker, Los Alamos National Laboratory.

More information: asa.aip.org/asasearch.html

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