Listening to the 9.0-magnitude japanese earthquake

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(PhysOrg.com) -- Last year's 9.0-magnitude Tohoku-Oki, Japan, earthquake was the fourth largest since 1900. However, because of thousands of seismometers in the region and Japan's willingness to share their measurements with the rest of the world, the Tohoku-Oki quake is the best-recorded earthquake of all-time.

This plethora of information is allowing scientists to share their findings in unique ways. Zhigang Peng, associate professor in Georgia Tech's School of Earth and Atmospheric Sciences, has converted the earthquake's seismic waves into audio files. The results allow experts and general audiences to "hear" what the quake sounded like as it moved through the earth and around the globe.

"We're able to bring earthquake data to life by combining seismic auditory and visual information," said Peng, whose research appears in the March/April edition of Seismological Research Letters. "People are able to hear pitch and amplitude changes while watching seismic frequency changes. Audiences can relate the earthquake signals to familiar sounds such as thunder, popcorn popping and fireworks."

The different sounds can help explain various aspects of the earthquake sequence, including the mainshock and nearby aftershocks. For example, the measurement above was taken near the coastline of Japan between Fukushima (the nuclear reactor site) and Tokyo. The initial blast of sound is the 9.0 mainshock. As the earth's plates slipped dozens of meters into new positions, aftershocks occured. They are indicated by "pop" noises immediately following the mainshock sound. These plate adjustments will likely continue for years.

As the waves from the earthquake moved through the earth, they also triggered new earthquakes thousands of miles away. In the below example, taken from measurements in California, the quake created subtle movements deep in the San Andreas Fault. The initial noise, which sounds like distant thunder, corresponds with the Japanese mainshock. Afterwards, a continuous high-pitch sound, similar to rainfall that turns on and off, represents induced tremor activity at the fault. This animation not only help scientists explain the concept of distant triggering to general audiences, but also provides a useful tool for researchers to better identify and understand such seismic signals in other regions.

The human ear is able to hear sounds for frequencies between 20 Hz and 20 kHz, a range on the high end for earthquake signals recorded by seismometers. Peng, graduate student Chastity Aiken and other collaborators in the U.S. and Japan simply played the data faster than true speed to increase the frequency to audible levels. The process also allows audiences to hear data recorded over minutes or hours in a matter of seconds.

Provided by Georgia Institute of Technology

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