2021 IRIS/SSA Distinguished Lecture Series

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Seismology with your Ears: Listening to Patterns in Tectonic, Volcanic and Human-induced Earthquakes

LECTURE ABSTRACT

Every earthquake emits seismic waves that spread from the ruptured part of a fault. We use these waves to locate and study the earthquake, and also to build an image of the Earth's interior. Over time, we accumulate "catalogs" of past earthquakes. Listening to seismic data by "speeding up" the waves to shifting them into our audible range, a process called sonification, can help us perceive patterns in data that could otherwise be missed. In this presentation, I will weave together many short movies – animations with sonified seismic waves – to demonstrate the rich and complex patterns of natural tectonic and volcanic earthquakes and then contrast them to patterns of human-induced earthquakes. California earthquakes convey a sense of the nearly constant, but random, seismic activity of an active tectonic fault. Earthquakes associated with volcanic eruptions have a very different variety of sounds and patterns. We will compare the incredible sequence of earthquakes in Kīlauea, Hawaiʻi during its 2018 eruption and contrast these with other eruptions. Finally, we will look at human-induced earthquakes associated with energy production. Listening to the differences between human-induced and tectonic earthquakes raises many important societal questions. In Oklahoma, a dramatic rise in earthquake occurrences were caused by injection of wastewater from shale gas extraction. In contrast, the extraction of geothermal energy, a CO2-free resource, also produces earthquakes but with minimal risk of groundwater contamination. All energy production comes with costs and risks to society, but how do we define and focus our concerns on the most critical ones? De-mystifying earthquake patterns through sonification can help in that direction.

SPEAKER BIO

Ben Holtzman is a geophysicist at the Lamont Doherty Earth Observatory of Columbia University in New York. He studies the mechanical behavior of rocks applied to problems such as how magma migrates through the planet's interior, how seismic waves propagate, and how earthquakes occur. He also works on "deep geothermal heat mining" – finding new ways to access the Earth's internal heat to generate electricity without producing greenhouse gases. Ben is the founder of the Seismic Sound Lab (www.seismicsoundlab.org), developed the SeismoDome program at the Hayden Planetarium in New York City, and is Scientist-in-Residence at the Computer Music Center at Columbia University. He studied Geology as an undergraduate at Brown University, received his Ph.D. in Geophysics at the University of Minnesota, and has worked at Lamont since 2004.

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