Listening to Earthquakes at the USGS

Overview

In this activity, you listen to sounds produced by seismic waves and note how they change according to magnitude, distance, and rock materials.

Learning Objectives

- Determine how the length of a fault, the type of material, the distance to the epicenter and the magnitude of an earthquake affect the frequency of seismic waves
- Compare seismic records for quakes with one feature changing and the others held constant
- Predict frequency (pitch) based on earthquake or seismogram characteristics.

Vibrations in the Earth

Seismologists say that the Earth "rings like a bell" after an earthquake as seismic waves travel through the crust and mantle and even the core (Fig. 1). Because thousands of earthquakes occur every year, shaking is almost continuous, although it varies in strength at different times and places. The U.S. Geological Survey (USGS) has developed a series of recordings from seismograms. When you listen to the audio, you can hear the "ringing", and changes in pitch correspond to differences in the earthquake or the situation of the seismometer.

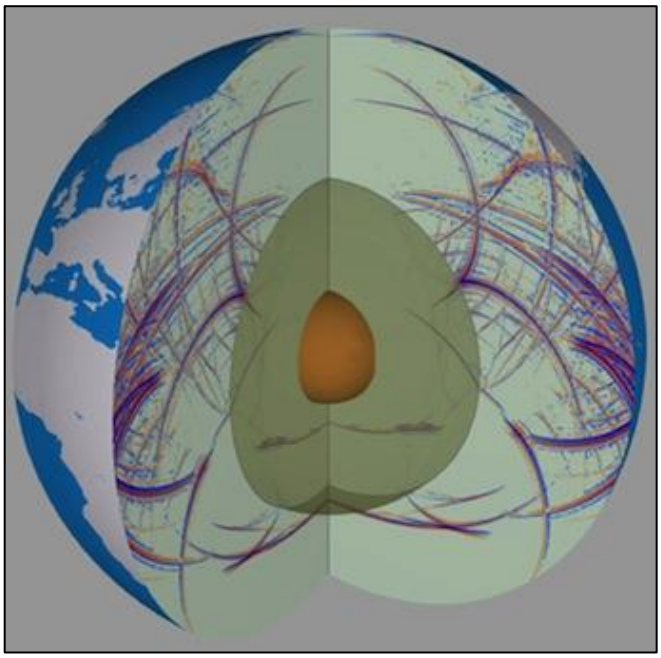

Figure 1. Model of seismic waves propagating throughout the Earth.

Earthquakes and Sounds

Go to the USGS "Listening to Earthquakes" website at the following URL: https://earthquake.usgs.gov/education/listen/index.php. **Read** the Introduction, and then work your way through all the pages: You will find the following links on the top left side of the website page.

- Fault Length Effects
- Distance Effects
- Rock Type Effects
- Multiple Earthquakes
- Earthquake Sounds for Fun
- Earthquake Music

Carefully listen to the various recordings and use what you read and hear to answer the questions below.

1. Why are these audio files "speeded up" with respect to the actual earthquake vibrations?

2. On the Fault Length Effects page, which earthquake occurred on the shorter fault, Earthquake One or Earthquake Two? How can you tell?

3. On the Distance Effects page, which seismometer was closer to the earthquake epicenter, Seismometer One or Seismometer Two? How can you tell?

4. On the Rock Type Effects page, which seismometer was on hard rock, Seismometer One or Seismometer Two? How can you tell?

5. On the Multiple Earthquakes page, which seismogram records small, triggered earthquakes, Parkfield or Geysers? How can you tell?

6. On the Earthquake Sounds for Fun page, consider the 1992 Landers earthquake with magnitude 7.3. Which seismogram records small, triggered earthquakes, the one recorded at Parkfield or the one recorded at Long Valley Caldera (Mammoth Lakes)?

7. On the Earthquake Sounds for Fun page, consider the 1992 Petrolia (near Eureka) earthquakes. Based on the magnitudes, which audio is higher pitched, that of the magnitude 6.5 earthquake or that of the magnitude 6.3 earthquake? Give one possible reason for your answer.

8. On the Earthquake Sounds for Fun page, consider the 1994 magnitude 5 Parkfield earthquake. Which audio is higher pitched, the one recorded at Parkfield or the one recorded at Hollister? Verify your answer by listening to the two recordings. Give one possible reason for your answer.

9. On the Earthquake Sounds for Fun page, consider the magnitude 2 Parkfield earthquake. Based on the rock types, which audio should be higher pitched, the one on hard rock or the one on chewed-up, fault zone rock? Verify your answer by listening to the two recordings.

10. On the Earthquake Music page, what four instruments/sounds are used in the quartet? Listen to “The Recording”, which is 1:54 seconds long. Why were these things/instruments chosen?