Raspberry Shake

Lesson #2

Digging Deeper with Raspberry Shake

Goal:

Increase your knowledge of how seismic activity works, how waves propagate (travel) through the earth, and how seismologists work to determine the location and magnitude of earthquakes. Use seismic data processing technology to practice understanding and identifying seismic waveforms.

Key Terms:

- Body Waves: Earthquake waves that travel through the interior of the earth
- Surface Waves: Earthquake waves that travel over the surface of the earth
- P-Waves: Primary (pressure) waves, the fastest traveling earthquake waves
- S-Waves: Secondary (shear) waves, the second fastest traveling waves
- Triangulation: Using data from three or more seismographs to identify earthquake epicenters. This process is done by identifying arrival times for the P and S waves at various stations
- Frequency: How frequently waves repeat from wave peak to wave peak

Reading for understanding:

Now that we know the basics of seismology, what seismic activity is, and how seismographs work, we can dive deeper into understanding seismic data.

What are waves?

To understand how seismologists interpret seismic waves, we must first understand what waves are. Waves are the transfer of energy through a medium.Seismic waves are a certain type of wave that result from earthquakes. All waves have certain characteristics: They all have a wavelength, amplitude, and frequency that distinguish them. The wavelength is the distance between consecutive peaks (tops) in a wave train. The amplitude is how “high” the wave is from peak to trough, and the frequency is how fast the wave is repeating from peak to peak.

The different types of seismic waves

When an earthquake occurs, it releases waves of energy that spread out from the focus point. There are two main types of waves: Body waves and Surface waves. Body waves travel *through* the earth’s interior, and Surface waves travel along the surface of Earth’s sphere.

Body waves include primary waves, or P-waves, and secondary, or S-waves. P-waves are also called compressional waves, because they push and pull material as they propagate. They are the fastest moving waves, and therefore are the first waves detected by seismographs.

The slower S-waves, also called shear waves because of the side-to-side movement they create as they pass through material, are picked up second by the seismographs. S-waves have a much lower frequency and therefore appear much larger on the seismograph.

Surface waves are the last to arrive, because they only travel over the less-direct path of the earth's crust. They are the most destructive type of earthquake wave, because of the distinctive orbital motion they cause. At a molecular level, surface waves behave similarly to ocean waves. In fact, ocean waves are a type of surface wave.

How do seismologists interpret seismic readings?

With the information that seismologists record on seismographs, they can determine the location, magnitude, and type of earthquake. One of the most important actions that seismologists must do when a new earthquake is recorded is identify the epicenter through triangulation. Triangulation is the use of seismic data from three or more seismographs to identify the epicenter, using the time interval between the arrival of the P and S-waves. The distance away from the seismograph the waves originated can be deduced from the signals, and with three or more seismographs, it is possible to identify the approximate location of the epicenter.

Practice:
Time: 20-25 Minutes — "Picking" P- and S- waves

Each get on a computer and navigate to locator.raspberryshake.net. Use the EQ Locator web app to practice triangulating earthquake epicenters by identifying P- and S- waves.

Students can then volunteer to share their experiences of using the EQ Locator app. Was triangulation, or "picking", as it is commonly referred to in seismology, easy or hard? How successful were you the teacher? Let the class know!

Closing:
Time: 5 minutes

Write a short reflection (2-5 sentences) making observations about using the earthquake locator.

Volunteers share with the class one thing they found challenging, and why.