Sounds of an Earthquake

Grade Level: 6-8

Purpose: Students will listen to a recording made during the magnitude 9.2 1964 Alaska earthquake to estimate duration of shaking and shaking strength. Students will be introduced to the Modified-Mercalli intensity scale and estimate the strength of shaking by looking at damage from the earthquake. Students will also explore how people can still function and make good decisions even when they are very frightened.

Time: 50 minutes for Part A, Part B steps#1-2,
50 minutes for Part B steps#2-4

Educational Standards:
LS1-1, LS1-3, LS1-8, LS2-1, LS2-4-5, WHST.6-8.1.a-e, ESS2-2, ESS3-2, PS3-2, PS4-2, PS3-5,

Materials:
Note – items in red are included in the list of Activity Documents
- Computer with internet access, projection technology to display photos from the computer onto a screen, and speakers to project sounds from a computer file to students
- Copies of handouts for student note taking: Sounds of a Quake Student Worksheet
- Sounds of the Alaska Quake teacher answer key Sounds of the Alaska Quake teacher answer key
- Copies of Handout for students: Simplified Modified Mercalli Scale
- For the teacher to read: Earthquake Intensity Notes by Lori Dengler
- For the teacher: Teacher Answer key - a Modified Mercalli Scale estimate and reasoning.

Procedure:
Teacher preparation: Listen to the recording ahead of time. Review the Mercalli scale and Lori Dengler's Earthquake intensity notes before the lesson. Before completing part B with the students be sure to review the pictures yourself.

A. Listening to sounds of an earthquake

1. Prepare students to listen to the recording of Mr. Pate on the sounds of the earthquake. Tell them that he worked for a radio station and wanted to be a DJ. He had gotten into the habit of carrying a tape recorder with him and recording anything that seemed of interest to him. Explain that at times, due to the loud noises caused by the quake (the shaking of the house, objects falling), that it is sometimes difficult to understand what he is saying. These background noises are important clues to understanding the effects of an earthquake. Tell your students to listen for Mr. Pate's emotional reactions during the earthquake. Also explain that Mr. Pate was not injured in the earthquake and his home suffered no major damage, although many items fell off of shelves.

2. Go to:
Click on the Sounds of a Quake link in the materials list for this activity, or
open http://www2.humboldt.edu/rctwg/images/uploads/March1964_Alaska.mp3
to play the recording of sounds of the 1964 earthquake.

3. After listening to the recording, discuss how Mr. Pate reacted to the earthquake.

Discussion questions:

What was Mr. Pate's emotional state? (clues – what he says, how he sounds, he keeps repeating himself, he is breathing rapidly, he says he is very frightened)
What do you think is happening in his house?
How long do you think the earthquake lasted? How do you think we can find out (listen to the recording again and time it).

4. Hand out Sounds of a Quake Student Worksheet to each student. Tell the students they will hear the recording again and tell students to record their observations as they listen. Have one student act as a timekeeper and measure how long the shaking lasted.

5. After the recording, discuss student responses and help them supplement their notes as needed. (see Sounds of the Alaska Quake Teacher notes)

Discussion: Go through the questions on the worksheet

B. Introducing Intensity. Observing pictures of damage of an earthquake.

1. Ask students to describe the types of damage Mr. Pate talked about (in Part A). Explain to students that two different scales are commonly used for earthquakes. The most commonly used one is magnitude. It measures how much energy is released by the fault rupture and the bigger the fault and the more it moves, the larger the magnitude. Magnitude is like the wattage of a light bulb. No matter where you are, the power output is the same. Intensity is a measure of relative shaking strength and always varies from a maximum value usually near the earthquake source or epicenter, to zero at a place far enough away that no one feels it.

The measure of intensity depends on human observations. I nformation is gathered from interviews and specialists' reports of damage and is now primarily estimated from Did You Feel It web site observations. More information about intensity at https://earthquake.usgs.gov/learn/topics/mercalli.php and in the Dengler intensity notes pdf in the Activity list.

2. Give students a copy of the Modified Mercalli Scale.pdf and a copy of the Student Worksheet on Alaska Quake Photos.pdf First review the effects described for each intensity level on the Modified Mercalli sheet. Based on only the evidence in Mr. pate's audio recording, estimate the shaking level.

Discussion question: Do you think this is a good estimate of what the effects were in all of Anchorage (probably not – it's only one point and we can't see what happened to his house or others nearby, need more information).

3. One way to get more information is to look at photos from Alaska in 1964. Display pictures of damage from the 1964 Alaska Earthquake, one at a time on a screen in your classroom. https://earthquake.usgs.gov/earthquakes/events/alaska1964/1964pics.php Ask students to make an estimate on the Modified Mercalli Scale of the intensity of the earthquake in this section of Anchorage, based on their observations of the damage in each photo.

(1) First photo: The Five-story J.C. Penney Building, 5th Avenue and Downing Street, Anchorage, Alaska, partly collapsed by the March 28, 1964 earthquake. Note undamaged buildings nearby.
(2) Third Photo: Close-up of Government Hill Elementary School, which was destroyed by the Government Hill landslide. Anchorage, Alaska.

(3) Sixth Photo: Uplifted dock on Hinchinbrook Island, Prince William Sound. Land in this area rose about 8 feet during the earthquake, and the dock can now be used only at extremely high tides.
(4) The eleventh photo: The Hillside apartment building in Anchorage was severely damaged by the earthquake and has been razed. It was a split-level, five story building with steel posts and lintels, concrete floor slabs, and unreinforced concrete block walls and partitions.
(5) The twelfth photo: One span of the "Million Dollar" truss-bridge of the former Copper River and Northwestern Railroad was dropped into the Copper River by the earthquake, and the other truss spans were shifted on their piers.
(6) The thirteenth photo: The earthquake shifted the steel trusses of the Copper River and Northwestern Railroad bridge near Round Island from 1 to 2 feet. This view shows one of the displaced trusses, which pounded against an adjacent steel girder span. The girder span was moved to the right, its concrete pedestal was rotated, and the girder span almost fell into the river. Note the shortening indicated by buckling of the guardrail.
(7) The fourteenth photo: The rails in this approach to a railroad bridge near the head of Turnagain Arm were torn from their ties and buckled laterally by channel ward movement of the river banks during the earthquake. The bridge was also compressed and developed a hump from vertical buckling.
(8) The fifteenth photo: The rails were buckled by lateral movement of the embankment fill toward an underlying culvert, which had collapsed.

4. Review student notes on the Modified Mercalli Scale values and reasoning they assigned to each picture of earthquake damage (see teacher answer key on quake picutres).

5. What is the best estimate of shaking strength in Anchorage? Is it the same for each photo? Is it the same as the estimate they made from the audio recording? Tell students to write a summary paragraph describing what a person may see in the landscape after a large magnitude earthquake, using their picture descriptions from B(3) above. Students should include values on the Modified Mercalli scale with their descriptions of damage.

Extension Activities:
1. For video animations of seismic waves, go to: https://www.iris.edu/hq/inclass/search#type=1

2. Another Mercalli Scale exercise for grades 4 and up. This activity has students reading scripted information and drawing isoseismal lines on a town map based on what they hear.
https://www.shakeout.org/downloads/ShakeOut_ES5_MercalliScale.pdf

3. Computer simulation of an earthquake with forecast effects in the Mercalli Scale, grades 8-12. Measures are in metrics on this site.
https://www.apolo11.com/simulador.php