The Great California ShakeOut™

The purpose of the ShakeOut is not only to practice the Drop, Cover, and Hold On procedure, but also to promote a general understanding of earthquake science and why it is particularly important to be knowledgeable about it in California. While the potential earthquake hazards that surround us vary by location, everywhere in California is considered at high risk compared to the rest of the country because of our location at the boundary of two tectonic plates. We live in earthquake country.

EARTH SCIENCE ACTIVITY: Fault Block Models

BACKGROUND:

Earthquakes occur on faults. A fault is a thin zone of crushed rock separating blocks of the earth's crust, where two tectonic plates are grinding past each other. Stresses in the earth's outer layer push the sides of the fault together. The friction across the surface of the fault holds the rocks together so they do not slip (become off-set relative to each other) immediately when pushed sideways. Eventually enough stress builds up and the rocks slip suddenly, releasing energy in waves that travel through the rock and cause the shaking that we feel during an earthquake.

ACTIVITY:

Set-Up

Print out the three fault block model handouts – normal, reverse, and strike-slip. Decide how many copies of each model to make so that there is one handout per student. The strike-slip fault model has a central piece that is much more easily cut with a blade than with scissors. This model may be better used as a sample that is pre-made by the educator and shown to the students, while the students focus on making either the normal or the reverse fault models. Each student needs glue or tape and a pair of scissors to complete this activity; coloring materials are optional, but recommended.

Procedure

1. Distribute one fault block handout to each student.
2. Help the students determine what type of fault their model will depict based on the shape and motion of the blocks/sides; have them write this on their model.
3. Guide the students to color in one color or pattern for all areas marked with a circle, and another color/pattern for all areas marked with a square; the thick dotted lines represent a soil layer that has been disrupted (normal and reverse models) or a displaced river (strike-slip). Students do not need to color the flaps that are X-marked, as these will be covered up later.
4. Have the students cut along all outer lines of the model, and around the three outer sides of each X-marked flap.
5. Fold the models into shape along all black lines, except the diagonal fault lines.
6. Tuck the X-marked flaps into place and adhere with glue or tape to complete.

CONTENT:

On the reverse and normal fault handouts, the slant between the upthrown and downthrown blocks represents the fault, which is located between the two tectonic plates.

Reverse faults: At a reverse fault, the upthrown block rests on the downthrown block, so it would appear natural for the upthrown block to slide downwards due to gravity; however, upon observation, its motion is upward relative to the downthrown block, indicating that the two plates are undergoing compression. Because the two blocks (or plates) are being pushed towards each other, the block on top is forced to move upward, against gravity. Thus, it is moving in a reversed direction, resulting in a “reverse fault.”

Normal faults: As opposed to the blocks (plates) at a reverse fault, which undergo compression, the plates at a normal fault follow gravity and thus the downthrown block, which sits atop the upthrown block, slides downward.

Strike-slip faults: A strike-slip fault occurs where two plates are sliding past each other and stress builds up between them. Earthquakes occur as a result of this stress build-up being suddenly released, like the sudden snapping of a stick that is steadily bent backwards, or the breaking of an elastic band that is overstretched. As a result, things that were once aligned and unbroken – such as fences, paths, or rivers, become displaced by as much as several meters/yards where intersected by the fault.

Unlike the normal and reverse fault models, which depict soil/ground displacement from a side view, the strike-slip fault model shows displacement from a fault rupture visible across a landscape from a bird’s-eye view.

Faults can be centimeters to thousands of kilometers (fractions of an inch to thousands of miles) long. The fault surface can be vertical, horizontal, or at some angle to the surface of the earth. Faults can extend deep into the earth and may or may not extend up to the earth's surface. Faults that do not reach the earth’s surface are called “blind thrust faults.”

Students should have a general understanding of the various fault types before doing this activity, which allows them to view reverse, normal, and strike-slip faults in 3-D form.