Introduction
What is a fault?

A fault is a rock fracture where the two sides have been displaced relative to each other. An earthquake is what happens when these two blocks of the earth, seemingly stuck together, suddenly slip past one another. The surface where they slip is called the fault or fault plane. The slip causes a sudden shaking or vibration in the Earth due to the sudden release of energy from within the Earth.

Because of pressure and friction at depth, plates rarely slide quietly past each other. Stress builds up between them until it reaches a critical strain, and the accumulated potential energy is released as the earthquake. The higher the stress, the greater the energy released. (Remember when you first learned about the energy release of a rubber band under stress?) The relative motion between the plates controls what type of a fault results. (Note: The fault-model video lecture after the animations further describes the concepts above.)

When you snap your fingers (see box on right) the whole “fault plane” moves due to uniform friction release; an earthquake happens on a discrete area of the fault plane that becomes un-stuck.

Fault slip occurs in three stages:
1) initiation of sliding on a small part of the fault,
2) growth of the slip surface, and
3) termination of slip and fault healing.

Earthquakes occur on preexisting faults operating in a “stick-slip” mode. Earthquakes are “slip” episodes; they are followed by periods of no slip (“stick”), during which elastic strain increases away from the fault. Although some growth of the fault may occur with each earthquake, we can generally assume that for large earthquakes (M>6) the faulting process primarily involves repeated breaking of the same fault segment rather than creation of a new fault surface.”
About the Animations

These animations of four faults are elementary examples of fault motion intended for simple demonstrations. Faults are categorized into three general groups based on the sense of slip or movement. (Figures above.) If the main sense of movement on the fault plane is up or down, the fault is known as a dip-slip fault. Where the main sense of slip is horizontal the fault is known as a strike-slip fault. Oblique-slip faults have significant components of both strike and dip slip.

Normal fault — the block above the fault moves down relative to the block below the fault. This fault motion is caused by tensional forces and results in extension. [Other names: normal-slip fault, tensional fault or gravity fault] Examples include Basin & Range faults.

Reverse fault — the block above the fault moves up relative to the block below the fault. This fault motion is caused by compressional forces and results in shortening. A reverse fault is called a thrust fault if the dip of the fault plane is small. [Other names: reverse-slip fault or compressional fault.] Examples include the Rocky Mountains and the Himalayan Mountains.

Strike-slip fault — the movement of blocks along a fault is horizontal and the fault plane is nearly vertical. If the block on the far side of the fault moves to the left, as shown in this animation, the fault is called left-lateral (Figure 2). If it moves to the right, the fault is called right-lateral. The fault motion of a strike-slip fault is caused by shearing forces. [Other names: transcurrent fault, lateral fault, tear fault or wrench fault.] Examples include the San Andreas Fault, California; Anatolian Fault, Turkey.

Oblique-slip faulting suggests both dip-slip faulting and strike-slip faulting. It is caused by a combination of shearing and tension or compressional forces. Nearly all faults will have some component of both dip-slip (normal or reverse) and strike-slip, so defining a fault as oblique requires both dip and strike components to be measurable and significant.
**Vocabulary**

To accompany Background files for IRIS' Animation page. (Definitions from usgs.gov; nasa.gov; fema.gov)

**Asperity** — literally “roughness. It is an area on a fault that is stuck or locked. A type of surface roughness appearing along the interface of 2 faults. Physics the elastically compressed region of contact between two surfaces caused by the normal force.

**Compression** — fractional decrease of volume due to pressure.

**Crust** — the outermost major layer of the earth, ranging from about 10 to 65 km in thickness worldwide. The uppermost 15-35 km of crust is brittle enough to produce earthquakes. Oceanic crust is thinnest; continental crust is thickest.

**Dip** — the angle by which a rock layer or fault plane deviates from the horizontal.

**Dip Slip** — Dip-slip faults can be again classified into the types “reverse” and “normal”. A normal fault occurs when the crust is extended. Alternatively such a fault can be called an extensional fault. The hanging wall moves downward, relative to the footwall. A downthrown block between two normal faults dipping towards each other is called a graben. An upthrown block between two normal faults dipping away from each other is called a horst. Low-angle normal faults with regional tectonic significance may be designated detachment faults.

**Earthquake** — shaking or trembling of the earth that accompanies rock movements extending anywhere from the crust to 680 km below the Earth’s surface. It is the release of stored elastic energy caused by sudden fracture and movement of rocks inside the Earth. Part of the energy released produces seismic waves, like P, S, and surface waves, that travel outward in all directions from the point of initial rupture. These waves shake the ground as they pass by. An earthquake is felt if the shaking is strong enough to cause ground accelerations exceeding approximately 1.0 centimeter/second squared.

**Epicenter** — the point on the Earth’s surface directly above the **focus** of an earthquake.

**Fault** — a fracture or zone of fractures in rock along which the two sides have been displaced relative to each other. If the main sense of movement on the fault plane is up (compressional; reverse) or down (extensional; normal), it is called a dip-slip fault. Where the main sense of slip is horizontal the fault is known as a strike-slip fault. Oblique-slip faults have both strike and dip slip.

**Fault plane** — The plane along which the break or shear of a fault occurs. It is a plane of differential movement, that can be vertical as in a strike slip fault or inclined like a subduction zone fault.

**Fault zone** — Since faults do not usually consist of a single, clean fracture, the term fault zone is used when referring to the zone of complex deformation that is associated with the fault plane.

**Focus** — the point on the fault at which the first movement or break occurred. Directly beneath the epicenter at 1–50 km depth.

**Locked fault** — a fault that is not slipping because frictional resistance on the fault is greater than the shear stress across the fault (it is stuck). Such faults may store strain for extended periods that is eventually released in an earthquake when frictional resistance is overcome.

**Seismicity** — the geographic and historical distribution (the “where?” and “how often?”) of earthquakes.

**Tectonics** — large-scale deformation of the outer part of the Earth resulting from forces in the Earth.