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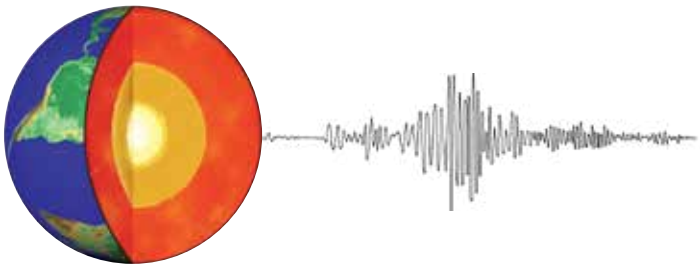

GLOSSARY OF GEOPHYSICS-RELATED TERMS AND CONCEPTS

With links to relevant **Animations** and **Videos**

Version 10/28/24

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Recursos en español?

Many of the IRIS resources have been translated into Spanish.

Visit the IRIS InClass Search page and select **Language** > **Spanish**, or link here: http://www.iris.edu/hq/inclass/search#language=2

IRIS animations in **Italian**:

https://www.iris.edu/hq/inclass/search#type=1/language=4

IRIS animations in **Greek**

https://www.iris.edu/hq/inclass/search#type=1/language=6

IRIS animations in **Chinese**:

https://www.iris.edu/hq/inclass/search#type=1/language=3

Glossary of Geophysics-Related Terms and Concepts

Definitions are drawn chiefly from *usgs.gov*; *nasa.gov*; and *fema.gov*

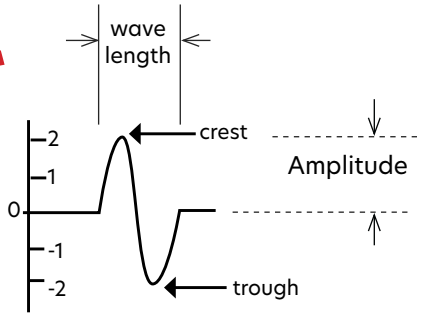
Blue are *hot* links to animations or videos that address the topic.

Acceleration—the velocity change in direction and/or speed over a period of time. For example, when you push on the gas pedal in the car, the car goes faster (acceleration). Pushing the brake pedal slows the car (deceleration). During an earthquake when the ground moves, it experiences acceleration. The peak ground acceleration is the largest increase in velocity recorded by a particular station during an earthquake. See Peak Acceleration.

Accelerometer—an electromechanical device that will measure ***acceleration*** forces**.** Used in ***seismographs***.

Aftershock—earthquakes that follow the largest shock (see ***Mainshock***) of an earthquake sequence. They are smaller than the mainshock and within 1-2 rupture lengths distance from the mainshock. Aftershocks can continue over a period of weeks, months, or years. In general, the larger the mainshock, the larger and more numerous the aftershocks, and the longer they will continue.
See also ***Foreshock*.**

Amplitude—the maximum disturbance or distance from a baseline. On a seismogram the horizontal time line is flat until there is a ground disturbance which is recorded as wave, or ***seismogram***. The amplitude of a seismic wave is the amount the ground moves up or down. Amplitude is one-half the distance between the crest and trough of one wavelength.



Amplification—increase in size or ***amplitude.*** Shaking levels at a site may be amplified by the focusing of seismic energy caused by the geometry of the sediment velocity structure, such as basin subsurface topography, or by surface topography. Softer sediment can amplify seismic waves.

Anticline—upward-curving (convex) fold in rock that resembles an arch. When eroded, the central part contains the oldest section of rock. See ***Fold*** and ***Syncline***.

Aseismic—describes a fault on which no earthquakes have been observed.

Asperity—literally "roughness. It is a type of surface roughness appearing along the interface of sides of a fault that are stuck or locked. (Physics: the elastically compressed region of contact between two surfaces caused by the normal force.)

Asthenosphere—the ductile part of the earth just below the ***lithosphere.*** It is about 180 km thick and is found 100-250 km (60-150 mi) below the Earth's surface. The asthenosphere deforms more than the rigid crust or the lower mantle.

Attenuation—decrease in wave size, or ***amplitude,*** away from source. When you throw a pebble in a pond, it makes waves on the surface that move out from the place where the pebble entered the water. The waves are largest where they are formed and get smaller as they move away. Seismic waves attenuate away from the earthquake source. Watch USGS animation.

Benioff Zone—dipping planar (flat) zone of earthquakes that is produced by the interaction of a down-going oceanic crustal plate with a continental plate. These earthquakes can be produced by slip along the subduction thrust fault or by slip on faults within the down-going plate as a result of bending and extension as the plate is pulled into the mantle. Also known as the Wadati-Benioff zone.

Body Waves—waves that move within the Earth's interior or within a body of rock. P and S waves are body waves. See ***Surface Wave.***

Brittle Deformation—irreversible strain where the material fractures/breaks in response to stress. Watch Brittle Vs. Ductile.

Compression—when stress forces are applied to an area, there is a decrease in volume and an increase in potential energy. [See animation under Stress.]

Compression stress—the stress component perpendicular to a given surface, such as a fault plane, that results from forces applied perpendicular to the surface.

Compressional Wave—a longitudinal wave that produces compression and rarefaction (areas of high density and low density) as it travels through a medium (state of matter which can carry energy and/or light). Particle motion is in the direction of propagation. Examples are sound waves and P-waves.

Continental Rifting—process by which a continent stretches and splits apart; if successful, this process separates a larger continent into two smaller continents separated by an expanding ocean. See ***Plate Tectonics***.

Convergence—coming together or joining at a common point. At **Convergent Boundaries** tectonic plates are moving toward each other. See also ***Divergence***.

Convergent Boundary—when two or more tectonic plates are moving toward each other and either being shortened or heightened due to compression, or causing subduction. Watch: Plate Boundary: Convergent Margin.

Creepmeters—a combination of 2 monuments and a wire that span across a fault. Displacement of the wire is used to measure fault slip. Learn more Meters.

Crust—the outermost major layer of the earth, ranging from about 10 to 65 km (about 40.39 mi) in thickness worldwide. The uppermost 15-35 km (about 21.75 mi) of crust is brittle enough to produce earthquakes. Oceanic crust is thinner than continental crust. Often mistaken for the ***tectonic (lithospheric) plate.*** Watch Take 2: Plate vs. Crust.

Crustal Deformation—when Earth's surface changes shape due to tectonic forces. Rocks can be folded, faulted, sheared and/or compressed by Earth stresses. Deformation can be elastic (as in temporary) or permanent. This is the same as "ground deformation."

Deformation—process where rocks are folded, faulted, sheared, or compressed by Earth stresses. Deformation may be caused by natural hazards (earthquakes, volcanoes, and landslides), land subsidence, surface water level changes, and glacial ice movement.

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

Dip-slip Faults—inclined fractures where the blocks have mostly shifted vertically. See ***Normal*** and ***Reverse Faults.***

Directivity—an effect of a fault rupturing whereby earthquake ground motion in the direction of rupture propagation is more severe than that in other directions from the earthquake source. Watch USGS animation.

Divergence—moving apart from a common point. At **Divergent Boundaries** plates are moving apart. See also ***Convergence***.

Ductile Deformation—when rocks deform in a ductile manner they bend, instead of fracturing to form faults. The resulting structures are called folds. At high temperature and confining pressures, brittle rock can become ductile. Folds result from compressional or shear stresses acting over considerable time. This is also described as having irreversible strain. When the stress is removed the deformation remains. (Watch Faults, Plated Boundaries & Stress from 3:20.)

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 by humans if the shaking is strong enough to cause ground accelerations exceeding approximately 1.0 centimeter/second squared. ***Types of earthquakes*** include:

A) Tectonic Earthquake: occurs when the earth's crust breaks due to geological forces on rocks and adjoining plates that cause physical and chemical changes.

B) Volcanic Earthquakes: result from tectonic forces which occur in conjunction with volcanic activity.
C) Collapse Earthquakes: occur in underground caverns and mines during roof collapse.
D) Explosion Earthquakes: result from the detonation of nuclear and chemical devices.

Elastic Deformation—reversible strain. When stress is removed, the material will return to its original position or shape.

Elastic Properties—the measure of an object's ability to change shape when a force is applied to it and return to its original shape when the force on it is released.

Elastic Rebound—an object returning to its original shape after applying a force that changes its shape. Elastic Rebound Theory explains earthquakes as the result of the accumulation and release of stress and strain. Watch Subduction Zone: Simplified model of elastic rebound.

Elastic Response—a temporary deformation or change in shape due to acting forces. When forces are removed, it returns to the original state.

Elastic Strain—a form of strain that, when the deforming force is removed, the distorted body returns to its original shape and size. Earthquakes are caused by the sudden release of energy as strain is overcome and the sides of the fault move past each other. This form of energy release is the only kind that can be stored in sufficient quantity to be regionally damaging.

Epicenter—the point (map location) on the Earth's surface directly above the ***hypocenter,*** or focus of an earthquake**.** Watch Take 2:Epicenter vs. Hypocenter.

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.
See Normal Fault and Reverse Fault.

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. (Ex. San Andreas Fault Zone).

Focal Mechanism—a 2D depiction of an earthquake fault orientation and slip direction.

Focus—see ***Hypocenter***.

Fold—a bend or flexure in a rock that is a result of permanent deformation.

Footwall—the underlying side of a fault. Watch Fault Types: 3 Different responses to stress.

Foreshock—foreshocks are relatively smaller earthquakes that precede the largest earthquake in a series, which is termed the ***mainshock***. Not all mainshocks have foreshocks.

Fracture—a separation into two or more pieces due to strain building up past the material's breaking point. (Can also be known as irreversible strain.)

Geodesist—a scientist who measures Earth's shape, size, gravity, and motion, and measures coordinates of any point on it from what underlies all navigation and positioning to detecting the warning signs of a volcanic eruption. They also study the Earth's orientation in space. Watch NOAA: What does a geodesist do?, and 9 Impacts of Geodesy.

Geodesy—the science of accurately measuring the Earth's size, shape, orientation, mass distribution and how these vary with time.

Geophysicist—a scientist who aims to understand the shape, gravitational and magnetic fields, internal structure and composition, and the processes of Earth's surface like earthquakes and volcanoes. Watch What is Geophysics?

Global Navigation Satellite Systems (GNSS)—any of, or some combination of, the operational satellite constellation systems providing positioning, navigation, and timing. At this time, networks include GPS, Galileo (EU), BeiDou (China), GLONASS (Russia), QZSS (Japan), IRNSS-NAVIC (India).

Global Positioning System (GPS)—the U.S. satellite constellation for positioning, navigation, and timing. Radio signals transmitted by satellites allow receivers on or above the Earth's surface to determine their location based on the time delay from multiple satellites to the receiver. Watch How Does GPS Work?

GPS Station—a long-term or permanent station used to measure movements of the Earth's surface. The Network of the Americas (NOTA) contains 1200 continuously operating GPS stations managed as part of the U.S. National Science Foundation (NSF) geodetic facility. NOTA GPS stations are accurate to distances of less than one centimeter. Over multiple years of data collection, movements on the order of 1-2 mm (about 0.08 in)/year can be detected.

Ground Motion—ground motion is the movement of the earth's surface from earthquakes or explosions. Ground motion is produced by waves that are generated by sudden slip on a fault or sudden pressure at the explosive source and travel through the earth and along its surface.

Hanging Wall—the overlying side of the fault. Watch Fault Types: 3 Different responses to stress.

Hazard—a source of unpredictable, unplanned danger. See ***Seismic Hazard.*** Watch Take 2: Hazard vs. Risk.

Hypocenter—commonly termed the ***focus***, this is the point within the earth where an earthquake rupture starts. It is directly below the epicenter, generally between 1-50 km depth, but can be as deep as 600km in subduction zones. Watch Take 2: Epicenter vs. Hypocenter.

InSAR (Interferometric synthetic aperture radar)—a technique which uses phase changes between successive synthetic aperture radar images to measure ground ***deformation.*** Learn more: InSAR (Interferometric synthetic aperture radar).

Intensity (Shake Intensity)—the intensity is a number (written as a Roman numeral) describing the severity of an earthquake in terms of its effects on the earth's surface and on humans and their structures (i.e., what is experienced). See ***Magnitude***.
Watch Take 2: Magnitude vs. Intensity.

Interplate—pertains to processes between the earth's tectonic (lithospheric) plates.

Intraplate—pertains to processes within a tectonic plate.

Isoseismal—a contour or line on a map bounding points of equal ***intensity*** for a particular earthquake.

Kinetic energy—the energy an object possesses due to its motion.

Layers of the Earth—Earth consists of three main layers; the crust, mantle, and core. The brittle outer shell (crust and upper mantle) is responsible for earthquakes. Watch Layers of the Earth.

Lidar (Light detection and ranging)—a remote sensing technology that measures distance by sending laser pulses and calculating reflection return times. This yields highly accurate topography and can reveal surface features through vegetation. Lidar can be used for hazard assessment applications, stratigraphic analyses, understanding geomorphic and tectonic processes and yield canopy volume and density in vegetated areas. Learn more Lidar (Light detection and ranging).

Liquefaction—a process by which water-saturated sediments temporarily lose strength and act as a fluid. This can happen when you wiggle your toes in the wet sand near the water at the beach. This effect can be caused by earthquake shaking.

Lithosphere—is the solid, rocky, outer part of the Earth, ~100 km thick (60 miles) comprised of the crust and the solid portion of the mantle. The thickness is age dependent with older lithosphere is thicker than younger oceanic lithosphere. The lithosphere below the crust is brittle enough at some locations to produce earthquakes by faulting, such as within a subducted oceanic plate. The continental lithosphere made mostly of granitic rock and 40-280 km thick is less dense than the oceanic lithosphere which is made mostly of basaltic rock and is approximately 5-10 km thick.

Lithospheric Plate—see ***Lithosphere*** and ***Tectonic Plate.*** Watch Take 2: Plate vs. Crust.

Locked fault—a fault that is not slipping because frictional resistance 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.

Love Waves—seismic waves that travel on Earth's surface layer. With this type of surface wave, particle motion is parallel to the surface and perpendicular to the direction of wave propagation. Watch Love Wave Motion.

Magma—molten rock material that is liquid or pasty which originates within the earth. Molten rock is below the surface of the Earth. Lava is molten rock on the surface of the Earth.

Magnitude—a number that characterizes the relative size of an earthquake. Magnitude is based on measurement of the maximum motion recorded by a seismograph. Several scales have been defined, but the most commonly used are: (1) local magnitude (ML), commonly referred to as "***Richter magnitude***," (2) surface-wave magnitude (Ms), (3) body-wave magnitude (Mb), and (4) ***moment magnitude*** (Mw). Scales 1-3 have limited range and applicability and do not satisfactorily measure the size of the largest earthquakes. The moment magnitude (Mw) scale, based on the concept of seismic moment, is uniformly applicable to all sizes of earthquakes but is more difficult to compute than the other types. All magnitude scales should yield approximately the same value for any given earthquake. Watch Take2: Magnitude vs. Intensity.

Mainshock—the largest earthquake in a sequence, sometimes preceded by one or more foreshocks, and often followed by aftershocks.

Mantle—the layer in Earth's interior between the crust and the metallic core. The uppermost mantle is part of the ***tectonic plate***.

Material Properties of the Earth—the bulk character of the rock, such as composition, density, elastic moduli, mineralogy, and phase (ex. the presence of melt). Elastic waves may propagate through the earth in a manner which depends on the material properties of the earth. The elasticity of the material provides the restoring force of the wave.

Mineral—a naturally occurring, inorganic, homogeneous solid with a crystalline structure.

Modified Mercalli Intensity Scale—a commonly used ***intensity*** scale that assigns a number describing the perceived severity of an earthquake in terms of its effects on the earth's surface and on humans and their structures. See ***Intensity***.

Moho—the boundary between the crust and the mantle in the earth. This is a depth where seismic waves change velocity and there is also a change in chemical composition. The boundary is between 25 and 60 km deep beneath the continents and between 5 and 8 km deep beneath the ocean floor. Also termed the Mohorovicic' discontinuity after the Croatian seismologist Andrija Mohorovicic' (1857-1936) who discovered it.

Moment Magnitude—the preferred measure of earthquake size (***magnitude***) which takes into account the stiffness of the rock, the average slip on the rupture plane, and the area of the rupture plane in addition to the maximum motion (amplitude) recorded by a seismograph (the "moment" of the earthquake). See ***Magnitude***.

Normal Fault—a fault, formed by extension, where the main sense of movement on the ***hanging wall*** is down.

Oblique-slip Fault—a type of fault where the slip is in both a horizontal and vertical directions (moves diagonally). It has both ***strike-slip*** and ***dip-slip*** components.

P Wave—the primary body wave; the first ***seismic wave*** detected by seismographs; able to move through both liquid and solid rock. Also called compressional or longitudinal waves, they compress and expand (oscillate) the ground back and forth in the direction of travel, like sound waves that move back and forth as the waves travel from source to receiver. P wave is the fastest wave.

Peak Acceleration—largest increase in velocity recorded by a particular station during an earthquake. (Commonly called PGA for peak ground acceleration). See ***Acceleration*** and ***Spectral Acceleration***. Learn more PGA-Wiki.

Plastic Deformation—an objects ability to change shape under an additional amount of stress beyond its elastic limit before it breaks.

Plate—a large, relatively rigid segment of the Earth's lithosphere that moves in relation to other plates over the asthenosphere. See ***Plate Tectonics*** and ***Lithospheric Plate***. Watch Myth-conception: Plate vs. Crust.

Plate Boundary—the tectonically active contact between tectonic plates can be convergent, divergent, and transform.

Plate Tectonics—the theory supported by a wide range of evidence that considers the earth's crust and upper mantle to be composed of several large, thin, relatively rigid plates that move relative to one another. Slip on faults that define the plate boundaries commonly results in earthquakes. See ***Tectonic Plate*** and ***Lithospheric Plate.*** (Watch the animations: History of Plate Tectonics Theory and What are the Forces that Drive Plate Tectonics.)

Potential Energy—the stored energy of an object due to its position or condition.

Primary Wave—See ***P Wave.***

Propagate—to cause a wave to move through a medium (any state of matter that can carry energy or light).

Rate—an expression that describes a change in position or velocity with respect to time.

Rayleigh Waves—seismic waves that travel on Earth's surface layer. With this type of ***surface wave***, particles move in an elliptical motion, producing both a vertical and horizontal component of motion in the direction of wave propagation. Watch Rayleigh Wave Motion.

Recurrence Interval—the average period of time between earthquakes in a seismic region.

Reference Frames—an area set as a stationary point so that all other plate motions can be measured with respect to it.

Reflection—occurs when energy or a wave bounces off of a boundary such as light reflecting off of a mirror, or seismic waves bouncing off of a boundary between two different materials within the earth.

Refraction—with respect to (1) earthquakes and (2) tsunamis:
(1) The deflection, or bending, of the ray path of a seismic wave caused by its passage from one material to another having different elastic properties.
(2) Bending of a tsunami wave front owing to variations in the water depth along a coastline.

Resonance—all matter vibrates at some natural frequency which depends on its molecular structure; this is also called the natural frequency of oscillation or resonant frequency. The structure remains stable at this frequency. Resonance occurs when an outside force with a matching vibration frequency hits an object (like a seismic wave hitting a building). This causes an added vibration which increases the amplitude of the natural frequency vibration waves so much that the structure becomes unstable and can break apart. Ex. someone singing and shattering a glass. Watch Building Resonance.

Reverse Fault—fault formed by compression, where the main sense of movement on the hanging wall is up.

Richter Scale—mathematical device to compare the size of earthquakes that is applicable for local earthquakes below magnitude 7. (For larger earthquakes see ***Moment Magnitude.***) The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included for the variation in the distance between the various seismographs and the epicenter of the earthquakes. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude 5.3 might be computed for a moderate earthquake, and a strong earthquake might be rated as magnitude 6.3. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release

of about 31 times more energy than the amount associated with the preceding whole number value. The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology. See ***Magnitude***.

Ring of Fire—40,000-km-long region that surrounds the Pacific Ocean known for its 452 volcanoes and 90% of the world's earthquakes. Also called the Circum-Pacific belt, this zone of earthquakes includes 81% of the world's largest earthquakes.

Rock—a naturally occurring, solid, comprised of a combination of one or more minerals. Watch: Take 2: Hazard vs. Risk.

S Waves—shear waves that are secondary body waves that oscillate the ground perpendicular to the direction of wave travel. They travel about 1.7 times slower than P waves. Because liquids will not sustain shear stresses, S waves will not travel through liquids like water, molten rock, or the Earth's outer core.

Segmentation—segmentation is the breaking up of a fault along its length into several smaller faults. This can happen as a result of other faults crossing it, topography changes, or bends in the strike of the faults. Segmentation can limit the length of faulting in a single earthquake to some fraction of the total fault length, thus also limiting the size of the earthquake.

Seismic Hazard—includes natural hazards associated with earthquakes that have potential to cause harm and affect the normal activities of people. This includes surface faulting, ground shaking, landslide, liquefaction, tectonic deformation, tsunamis, and seiches. See ***Seismic Risk***.

Seismic Moment—a parameter related to the angular leverage of the forces that produce slip on a fault; determined from the seismic waves and field measurements that describe the fault area. See ***Moment Magnitude***.

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

Seismic Risk—the probability (chance) that humans will incur loss or harm if someone or something that is vulnerable is exposed to a seismic hazard. See ***Seismic Hazard***.

Seismic Tomography—an imaging technique that uses seismic waves generated by earthquakes and explosions to create computer-generated, three-dimensional images of Earth's interior.

Seismic Wave—an elastic wave generated by an impulse such as an earthquake or an explosion. Seismic waves may travel either through the earth's interior (P and S waves; the fastest waves) or along or near the earth's surface (Rayleigh and Love waves). Seismic waves travel at speeds of several kilometers per second.

Seismogenic—capable of generating earthquakes. The base of the seismogenic (brittle) zone is the top of the ductile asthenosphere.

Seismogram—the real-time record of earthquake ground motion recorded by a seismograph. Seismograms are the records (paper copy or computer image) used to calculate the location and magnitude of an earthquake.

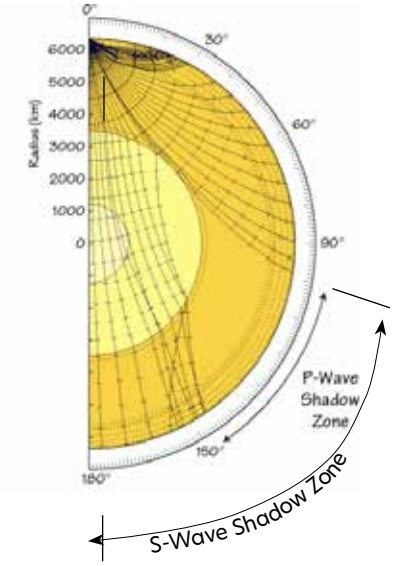
Seismograph—an instrument that records vibrations of the Earth, especially earthquakes. Seismograph generally refers to the seismometer plus a recording device as a single unit.

Seismology—science that deals with earthquakes and attendant phenomenon including the study of artificially produced elastic waves in the Earth's material.

Seismologist—a scientist who studies earthquakes, seismic waves, and their environmental effects. They use data from seismographs and other instruments to understand the causes of earthquakes, predict future seismic activity, and assess the potential hazards of different areas. The study of earthquakes and seismic waves provided evidence for plate tectonics and Earth's internal structure and composition. GSA: Seismologist Overview, AGI: Seismologist, and What is Seismology?

Seismometer—a sensitive instrument that can detect waves emitted by even the smallest earthquakes. See ***Seismograph***.

Shadow Zone—the area of the earth from angular distances of 104 to 140 degrees from a given earthquake that does not receive any direct P waves. This zone results from S waves being stopped entirely by the liquid core and P waves being bent (refracted) by the liquid core.



Seismic shadow zones.

ShakeAlert Early Warning System—The ShakeAlert® Earthquake Early Warning System, managed by the U.S. Geological Survey, detects significant earthquakes quickly enough so that alerts can be delivered to people and automated systems potentially seconds before strong shaking arrives. ShakeAlert is not earthquake prediction, rather a ShakeAlert Message indicates that an earthquake has begun and shaking is imminent." https://www.shakealert.org (Learn More: ShakeAlert Earthquake Early Warning System (EarthScope.)

Shear—type of strain in which the shape of a material is displaced laterally with no corresponding change in volume.

Shear Wave—See ***S wave.***

Slip—the relative motion between 2 sides of a fault plane which occurs when frictional forces are overcome. This motion is felt as an earthquake. The amount of surface area that slips is proportional to the size of the earthquake.

Solid—anything that retains a fixed volume and shape.

Spectral Acceleration—whereas ***peak acceleration*** **(PGA)** is what is experienced by a particle on the ground, spectral acceleration (SA) is approximately what is experienced by a building, as modeled by a particle on a massless vertical rod having the same natural period of vibration as the building.

Speed—the distance of movement in a specified amount of time.

Strain—change in the shape or volume of a material, often recorded in three-dimensions. Strain is defined as the amount of deformation an object experiences compared to its original size and shape. For example, if a block 10 cm on a side is deformed so that it becomes 9 cm long, the strain is (10-9)/10 or 0.1 (sometimes expressed in percent, in this case 10 percent).

Stress—a measure of forces acting on a body. Stress is defined as force per unit area. It has the same units as pressure, and in fact pressure is one special variety of stress. However, stress is a much more complex quantity than pressure because it varies both with direction and with the surface it acts on. Watch How Stress is related to plate boundaries.

Strike-slip Fault—the main sense of slip across the fault is horizontal. Can be right lateral (ground on opposite side of fault is moving right with respect to the other block) or left lateral (ground opposite moves left).

Strong Motion—ground motion of sufficient amplitude and duration to be potentially damaging to a building or other structure.

Subduction—the process of one tectonic plated converging and descending beneath another. An oceanic plate can subduct under another oceanic plate like the Pacific Plate subducting under the North American Plate near Alaska. An oceanic plate can subduct under a continental plate; for example, the Juan de Fuca Plate is subducting under the North American Plate. See ***Convergent Boundary***.

Subduction Zone—a convergent plate margin in which one lithospheric plate descends beneath another. These interactions can produce natural hazards like earthquakes, tsunamis, volcanoes, and landslides. See ***Convergent Boundary***. Watch Pacific NW - The Cascadia Subduction Zone.

Surface Wave—waves that move close to or on the outside surface of the Earth rather than through the deep interior like the faster P or S waves. Two principal types of surface waves, Love and Rayleigh waves, are generated during an earthquake. Rayleigh waves cause both vertical and horizontal ground motion, and Love waves cause horizontal motion only. They both produce ground shaking at the Earth's

surface but very little motion deep in the Earth. Because the amplitude of surface waves diminishes less rapidly with distance than the amplitude of P or S waves, surface waves are often the most important component of ground shaking far from the earthquake source.

Syncline—a downward-curving (concave) fold in rock. After erosion, the youngest beds are exposed in the central core of the fold. See ***Fold*** and ***Anticline.***

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

Tectonic Earthquake—an earthquake that is due to the movement of the tectonic plates. Tectonic earthquakes will occur anywhere within the earth where there is sufficient stored elastic strain energy to drive fracture propagation along a fault plane. Other earthquakes can be caused by blasts or volcanic activity.

Tectonic Plates—the large thin, relatively rigid slabs that move relative to one another on the outer surface of the Earth. Comprised of the solid section of the Earth's crust and outermost mantle that moves over the deeper mantle. Also known as ***Lithospheric Plate***.

Teleseismic—earthquakes at distances greater than 1,000 km from the measurement site.

Tension, Tensional Force—forces that pull a material in opposite directions causing stress as a result of the material stretching or extending. In geosciences, the rocks become longer in a lateral direction and thinner in a vertical direction. One important result of tensile stress is jointing (fractures due to overstretching) in rocks.

Tiltmeter—a very sensitive inclinometer that measures the change from horizontal. Tiltmeters are used to monitor faults, volcanoes, dams, potential landslides, and hydraulic fractures. Learn more Meters.

Vector—a physical quantity with a magnitude and direction, usually used for an object that cannot be expressed by a single number (a scalar). Velocity, force, and acceleration are examples of vectors while speed is an example of a scalar (has magnitude only). https://earthobservatory.nasa.gov/glossary/all https://www.grc.nasa.gov/www/k-12/airplane/vectors.html and https://www.grc.nasa.gov/www/k-12/WindTunnel/Activities/vectors.html.

Velocity—the speed and direction of movement. For example, how fast and in which direction a seismic wave travels.

Velocity Structure—a generalized regional model of the earth's crust that represents crustal structure using layers having different assumed seismic velocities.

Velocity Vector—is a visual representation of the velocity of movement with speed indicated by the length of the vector and the direction indicating the direction of movement from North.

Volcanologist—a scientist who studies volcanoes: how and why they erupt, their behavior, and all the formations and processes that are related to them.

Wave—a disturbance that moves through a medium (any state of matter that carries energy or light). See ***Seismic Wave***.

Wave Height—the vertical distance from a wave's crest to its trough. This measurement will be twice the amplitude measured for the same wave. See ***Amplitude.***

Wave Crest—the highest point a wave reaches. The lowest point is called its trough. See ***Amplitude.***

Wave Path—with respect to geology, as a wave travels through Earth, the path it takes depends on which type of wave it is, its velocity, and the material it passes through. ***Body waves*** and ***surface waves*** travel different paths.

Wave Trough—the lowest point a wave reaches. See ***Amplitude.***

Wavelength—the horizontal distance between two successive crests, often measured in meters.