The glossary of terms, which are frequently used in seismology and observatory practice, has been compiled by using, complementing and sometimes correcting glossaries published by the US Geological Survey (http://www.usgs.gov/), the Montana Bureau of Mines and Geology (http://www.mbmg.mtech.edu/) and the International Data Center of the CTBTO (http://www.ctbto.org). Thanks go to Christian Nerger and Johannes Schweitzer, who assisted the Editor in compiling and editing this glossary. Note that words which are written in *italics* in the explanatory text refer to other key words for which more explanation is given elsewhere in the glossary.

acceleration	When an object, e.g., a car, changes its speed from one speed to another, it is accelerating (moving faster) or decelerating (moving slower). This change in velocity is called acceleration. When the ground is shaking during an earthquake or another kind of seismic source process, it also experiences acceleration. The peak acceleration is the largest acceleration recorded by a particular station during an earthquake. In strong-motion seismology the ground acceleration is commonly expressed as a fraction or percentage of the acceleration due to gravity (g) where g = 981 cm/s². For the strongest earthquakes ground accelerations of more than 1.5 g have been recorded. Since the weight of an object, e.g., of a building, is equal to its mass multiplied by the gravity g the additional acceleration due to *ground shaking* causes an extra load. This extra load may exceed the strength of the building and may cause damage or even a collapse.
accelerogram	The recording of ground acceleration as a function of time during a seismic event.
accelerograph	A compact, rugged, and relatively inexpensive instrument that records the signal from an *accelerometer*. Film used to be the most common recording medium, modern accelerographs, however, record digitally with much larger dynamic range.
accelerometer	A sensor whose output is almost directly proportional to ground *acceleration*. The conventional strong-motion accelerometer is a simple, nearly critically damped oscillator having a natural frequency of about 20 Hz.
accretionary wedge	Sediments that accumulate and deform where oceanic and continental plates collide. These sediments are scraped off the top of the downgoing oceanic crustal plate and are added to the leading edge of the continental plate (see *subduction* and *tectonic plate*).
active fault	A fault that is considered likely to undergo renewed movement within a period of concern to humans. Faults are commonly considered to be active if they have moved one or more times in the last 10,000 years, but they may also be considered active when assessing the hazard for very critical installations such as nuclear power plants even if movement has occurred in the last 500,000 years. Usually, the fault movements are (at least partially) ruptural, i.e., connected with earthquakes, however slow (creeping) movements are possible as well.

Glossary

aftershocks	Earthquakes that follow the largest shock of an earthquake sequence. They are smaller than the mainshock and within 1-2 fault lengths distance from the mainshock fault. Aftershocks can continue over a period of weeks, months, or years, decreasing in frequency with time. In general, the larger the mainshock, the larger and more numerous the aftershocks, and the longer they will continue.
alluvium	Loose gravel, sand, silt, or clay deposited by streams after the last ice age (see *holocene*).
Alpide belt	Mountain belt with frequent earthquakes that extends from the Mediterranean region, eastward through Turkey, Iran and northern India.
amplification	Most earthquakes are relatively small, in fact, so small that no one feels them. In order for seismologists to see the recording of the ground movement from smaller earthquakes, the recording has to be made larger. It's like looking at the recording through a magnifying glass, and the amount that it is magnified is the amplification. Modern seismographs are able to magnify the *ground motion* 10^6 times or even more, i.e., they are able to resolve ground motion amplitudes as small as the diameter of molecules or even atoms. Shaking levels at a site may also be increased (or decreased) by focusing (or defocusing) of seismic energy caused by the geometry and the *velocity structure* of sediments, such as basin subsurface topography, or by surface topography. Both the amplification of seismographs and of the subsoil structure is usually dependent on the *frequency* of the *seismic signal*.
amplitude	The size of the wiggles on an earthquake recording; more general the height of a wave-like disturbance (called *waveform*) from the medium (zero) level to its peak. In seismology *ground motion* amplitudes are usually measured in nanometers (10^{-9} m) or micrometers (10^{-6} m). Often the double amplitude (called peak-to-peak or peak-to-trough) is measured.
anisotropic	A medium is anisotropic when its physical properties, e.g., the velocity of seismic waves or the hardness of rocks, depend on the direction considered.
array	An ordered arrangement of *seismometers* or *geophones*, the data from which feeds into a central *data acquisition* and *data processing* unit.
arc (volcanic)	A chain of volcanoes (volcanic arc) that sometimes forms on land or as volcanic islands in the sea, when an oceanic plate collides with a continental plate and then slides down underneath it (*subduction*).
arias intensity	A ground-motion parameter derived from an accelerogram and proportional to the integral over time of the acceleration squared. Expressed in units of *velocity* (m/s or cm/s).
arrival	The appearance of seismic energy on a seismic record.
arrival time	The time at which a particular wave phase arrives at a station.

aseismic	This term describes a fault (an area) on which (where) no earthquakes have been observed and are not likely to occur. Aseismic behavior may be due to lack of shear stress across the fault, a locked fault condition with or without shear stress, or release of stress by fault creep.
association (of arrivals)	To assign a seismic wave *arrival* to a specific seismic event.
asperity	A region on a *fault* of high strength produced by one or more of the following conditions: increased normal stress, high friction, low pore pressure, or geometric changes in the fault such as fault bends, offsets, or roughness. This term is used in two contexts: it may refer to sections of a fault that radiate uncommon seismic energy or it may refer to locked sections of the fault that cause fault segmentation.
asthenosphere	The ductile part of the Earth, just below the brittle *lithosphere*, in the upper *mantle*. The lithosphere/asthenosphere reaches down to about 200 km.
attenuation	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 gradually get smaller as they move away. This decrease in wave amplitude is caused by *geometrical spreading* and by attenuation of seismic wave energy. The latter is due to two different processes: 1) absorption (termed anelastic attenuation) in different Earth materials and b) scattering of seismic energy at heterogeneities in the Earth (e.g., faults or small-scale anomalous geological bodies). Q and kappa are attenuation parameters used in modeling the attenuation of *ground motion*s.
attribute (of an arrival)	A quantitative measure of a seismic *arrival* such as *onse*t time, (*back-)azimuth, slowness, period* and *amplitude*.
azimuth	In general a direction measured clock-wise in degrees against north. In seismology used to measure the direction from a seismic source to a seismic station recording this event..
backarc	The region landward of the chain of volcanoes (volcanic *arc*), in a *subduction* system.
backazimuth	The direction from the seismic station towards a seismic source, measured in degrees clock-wise against north; in short, sometimes also just called azimuth.
background noise	Permanent movements of the Earth as seen on seismic records caused by ocean waves, wind, rushing waters, turbulences in air-pressure, etc. (ambient natural noise), and/or by traffic, hammering or rotating maschinery, etc. (man-made noise).
backstop	Continental rocks in the *backarc* that are landward from the trace of the subduction thrusth fault and that are strong enough to support stress accumulation. These rocks are both igneous and dewatered, lithified, consolidated sediments that probably were part of the *accretionary-wedge*. The softer accretionary-wedge rocks are strongly deformed as they accumulate against the backstop. The exact position and dip direction of the backstop is not well determined, and more than one backstop may exist.

Glossary

basement	Igneous and metamorphic rocks that underlie the sedimentary-rock sequences and extend downward to the base of the crust.
beam	A waveform created from *array* station elements that are specifically summed up for the direction of a specified *backazimuth* and apparent velocity (*slowness)*.
bedrock	Relatively hard, solid rock that commonly underlies softer rock, or soil, a subset of the basement.
Benioff zone	see *Wadati-Benioff zone*
blind fault	A fault that does not rupture all the way up to the surface so there is no evidence of it on the ground. It is "buried" under the uppermost layers of sediments or rock in the crust.
body wave	A seismic wave that propagates through the interior of the Earth, as opposed to *surface waves* that propagate near the Earth's surface. *P* and *S waves*, which shake the ground in different ways, are examples.
branch (of travel-time curve)	Term used in seismology for "branching" *travel-time curves* that are related to discrete ray paths of the same type of wave and due to strong velocity *gradients* and/or *low-velocity layers* in the Earth's interior, e.g., the P-wave branches due to the upper mantle discontinuities at 410 km and 660 km depth or the travel-time branches of the core phases PKPab, PKPbc and PKPdf.
brittle-ductile boundary	The depth in the crust across which the thermo-mechanical properties of the crust change from brittle behavior (tending to break) to ductile behavior (tending to bend). Most earthquakes initiate at or above this depth on steep (high-angle) faults, below this depth, fault slips may be *aseismic* and may grade from high angle to low angle.
bulk density	The mass of a material divided by its volume, including the volume of its pore spaces.
$_{14}$C age date	An absolute age obtained for geologic materials containing bits or pieces of carbon using measurements of the proportion between the radioactive carbon ($_{14}$C) and the non-radioactive carbon ($_{12}$C). These dates are independently calibrated with calendar dates. The method is used to determine when past earthquakes occurred on a fault.
calibration	The process of determining the *response function* and sensitivity of an instrument or its derived channel.
calibration pulse	An electronic signal used to calibrate seismic instruments.
channel (of a record)	Usually the signal output of a one-component *seismic sensor*. Modern seismic recorders (see *data logger*) are usually able to record simultaneously the signals from many *seismic sensor components*.
Circum-Pacific belt	The zone surrounding the Pacific Ocean that is characterized by frequent and strong earthquakes and many volcanoes as well as high tsunami hazard. Also called the *Ring of Fire.*
coda	The tail of a *seismic signal*, usually with exponentially decaying *amplitudes*, which follow a strong wave *arrival*. Coda waves are due to scattering and superposition of multi-path arrivals.
coda phase	A detection of a single phase of unknown path found within the coda signal envelope, designated as tx, Px or Sx.

coherent	*Seismic signals* detected on various *seismic sensors* of an *array* or network of *seismic stations* are said to be coherent if they are related to each other in time, *amplitude* and/or *waveform* because they come from the same seismic source.
cohesionless	Referring to the condition of a sediment whose shear strength depends only on friction because there is no bonding between the grains. This condition is typical of clay-free sandy deposits.
colluvium	Loose *soil* or rock fragments on or at the base of gentle slopes or hillsides. Deposited by or moving under the influence of rain wash or downhill creep.
component	(1) One dimension of a three-dimensional signal, (2) The vertically- or horizontally-oriented (north or east) sensor of a seismic station.
compressional stress	The stress that squeezes something. It is the stress component perpendicular to a given surface, such as a fault plane, that results from forces applied perpendicular to the surface or from remote forces transmitted through the surrounding rock.
compressional wave	See *P wave*
convolution	A mathematically equivalent operation that describes the action of a linear (mechanical and/or electronic) system on a signal, such as that of a filter on a *seismic signal*.
core	The innermost part of the Earth. The outer core extends from about 2900 to about 5120 km below the Earth's surface and consists in its main components of a mixture of liquid iron and nickel. The inner core is the central sphere of the Earth with a diameter of 1250 km and consists of solid metal.
corner frequency	The frequency at which the curve representing the *Fourier amplitude spectrum* of a recorded seismic signal abruptly changes its slope. For earthquakes, this frequency is a property of the source and related to fault size, rupture velocity, source duration and stress drop in the source. Also the frequency at which the *transfer function* / *magnification curve* of a recording system changes its slope.
creep	Slow, more or less continuous movement occurring on faults due to ongoing tectonic deformation. Also applied to slow movement of landslide masses down a slope because of gravitational forces. Faults that are creeping do not tend to have large earthquakes. This fault condition is commonly referred to as unlocked.
critical facilities	Structures whose ongoing performance during an emergency is required or whose failure could threaten many lives. May include (1) structures such as nuclear-power reactors or large dams whose failure might be catastrophic, (2) major communication, utility, and transportation systems, (3) involuntary- or high-occupancy buildings such as schools or prisons, and (4) emergency facilities such as hospitals, police and fire stations, and disaster-response centers.
crossover	The distance from an event where two different *phase*s arrive at the same time, allowing constructive interference that sometimes enhances the signal amplitudes.

Glossary

crust	The outermost major layer of the Earth, ranging from about 10 to 70 km in thickness worldwide. The oceanic crust is thinner (about 10 to 15 km) than the continental crust (about 25 to 70 km). The uppermost 15-35 km of the crust is brittle enough to produce earthquakes. The seismogenic crust is separated from the lower crust by the *brittle-ductile boundary*. The crust is usually characterized by P-wave velocities below 8 km/s (average velocity of about 6 km/s).
damping	The reduction in amplitude of a seismic wave or oscillator due to friction and (or) the internal absorption of energy by matter.
data	Series of observations, measurements or facts.
data acquisition	Process of acquiring and storing data.
database	Systemized collection of data that can be manipulated by data processing systems for specific purposes.
data logger	Digital data acquisition unit, usually for multi-channel recordings.
data processing	Handling and manipulating of data by computer.
defining (of an arrival)	An arrival *attribute*, such as *arrival time*, *azimuth*, *slowness*, or *amplitude* and *period*, which is used in the calculation of location or magnitude of the *seismic source*.
deformation	A change in the original shape of a material. When we are talking about earthquakes, deformation is due to stress and strain.
design earthquake	The postulated earthquake (commonly including a specification of the *ground motion* at a site) that is used for evaluating the earthquake resistance of a particular structure.
detection	Identification of an *arrival* of a *seismic signal* with *amplitudes* above and/or signal shape (waveform) different from seismic *noise*.
deterministic methods	Refers to methods of calculating *ground motion*s for hypothetical earthquakes based on earthquake-source models and wave-propagation methods that exclude random effects.
dip	Inclination of a planar geologic surface (for example, a *fault*) from the horizontal (measured in degrees).
dip slip	See *fault*.
directivity	An effect of a propagating fault rupture whereby the amplitudes of the generated *ground motion*s depend on the direction of wave propagation with respect to fault orientation and slip direction (radiation pattern). The directivity and thus the radiation pattern is different for P and S waves.
discriminant	A characteristic feature of a *seismic signal* that can be used to categorize its *source*, classifying it as originating from an *earthquake*, mining blast or collapse, nuclear detonation, or any other type of event.
disk loop	A storage device that continuously stores new waveform data while simultaneously deleting the oldest data on the device.

displacement	The difference between the initial position of a reference point and any later position. (1) In *seismology*, displacement is the *ground motion* commonly inferred from a *seismogram*. For example it may be calculated by integrating an accelerogram twice or a velocity proportional recording once with respect to time and is expressed in units of length, such as nanometer, micrometer or millimeter. (2) In geology, displacement is the permanent offset of a geological or man-made reference point along a fault or a landslide.
earthquake	*Ground shaking* and radiated seismic energy caused most commonly by sudden slip on a fault, volcanic or magmatic activity, or any other sudden stress changes in the Earth. An earthquake of magnitude 7 or larger is termed a great earthquake.
earthquake hazard	Any physical phenomenon associated with an earthquake that may produce adverse effects on human activities. This includes *surface faulting, ground shaking, landslides, liquefaction, tectonic deformation, tsunami*, and *seiche* and their effects on land use, man-made structures, and socio-economic systems. A commonly used restricted definition of earthquake hazard is the probability of occurrence of a specified level of *ground shaking* in a specified period of time.
earthquake risk	The expected (or probable) life loss, injury, or building damage in the case of an earthquake or in relation to the given *earthquake* hazard of an area. In common language, earthquake risk and earthquake hazard are occasionally used interchangeably.
earthquake swarm	A series of minor *earthquakes*, none of which may be identified as the main shock, occurring in a limited area and time period.
elastic dislocation theory	In *seismology*, the theoretical description of how the elastic Earth responds to fault slip, as represented by a distribution of displacement discontinuities.
elastic wave	A wave that is propagated by some kind of elastic deformation, that is, a deformation that disappears when the deforming forces are removed. A seismic wave is a type of an elastic wave.
epicenter	The point on the Earth's surface vertically above thepoint where a seismic rupture begins.
event (seismic)	General term used for a localized disturbance (earthquake, explosion, rock burst, mining collapse, volcanic event) which generates seismic waves.
f_{max}	The frequency above which little seismic energy is observed at most strong-motion stations. This frequency cutoff may be produced by attenuation of the shaking by unconsolidated sediments underlying the recording site or may be a property of the source function.

fault	A fracture along which the two sides have been significantly *displaced* relative to each other in parallel to the fracture. Strike-slip faults are vertical (or nearly vertical) fractures along which rock masses have mostly shifted horizontally. If the block opposite an observer looking across the fault moves to the right, the slip style is termed right lateral, if the block moves to the left, the motion is termed left lateral. Dip-slip faults are inclined fractures along which rock masses have mostly shifted vertically. If the rock mass above an inclined fault moves down (due to lateral extension) the fault is termed normal, whereas if the rock above the fault moves up (due to lateral compression), the fault is termed reverse (or thrust). Oblique-slip faults have significant components of both slip styles (i.e., strike slip and dip slip).
fault creep	See *creep*.
fault gouge	Crushed and ground-up rock produced by friction between the two sides when a fault moves.
fault plane	The planar (flat) surface along which there is slip during an earthquake.
fault movement	Sense of motion along a fault which separates two adjacent crustal blocks. One speaks of normal faulting, if the block overlaying the other block along an inclined fault plane is downthrown, and of reverse or thrust faulting, if the overlaying block is overriding the block underneath or the underlaying block is thrusted/subducted underneath the overriding block, respectively (see *subduction thrust fault*). In the case of a steeply dipping fault plane and more or less horizontal, i.e., strike-slip block movement, one discriminates between left-lateral and right-lateral strike-slip movements. Left-lateral means that if you were to stand on the fault and look along its length, that the left block moves towards you, whereas in the case of right-lateral movement the block on your right side moves towards you.
fault-plane solution	A way of showing the *fault* and the direction of slip on it from an *earthquake*, using circles with two intersecting curves that look like beach balls. A fault-plane solution is found by an analysis using stereographic projection or its mathematical equivalent to determine the attitude of the causative fault and its direction of slip from the *radiation pattern* of seismic waves using earthquake records at many stations. The most common analysis uses the direction of *first motion* of *P-wave* onsets and yields two possible orientations for the fault rupture and the direction of seismic slip. Another technique is to use the polarization of teleseismic *S waves* and/or to measure amplitude ratios between different phase types. From these data, inferences can be made concerning the principal axes of stress in the region of the earthquake. The principal stress axes determined in this method are the *compressional* axis (also called the P-axis, i.e. the axis of greatest compression, or s_1), the *tensional* axis (also known as the T-axis, i.e., the axis of least compression, or s_3), and the intermediate axis (s_2).

fault scarp	Step-like linear landform coincident with a fault trace and caused by geologically recent slip on the fault.
fault trace	Intersection of a *fault* with the ground surface, also, the line commonly plotted on geologic maps to represent a fault.
Fennoscandia	The northern European region comprising the Caledonids and the Baltic shield of Finland, Scandinavia, and the Kola Peninsula of northwestern Russia.
filter(ing)	*Attenuation* of certain frequency components of a (*seismic*) *signal* and the amplification of others. For a recorded signal, the process can be accomplished electronically or numerically in a computer. Filtering also occurs naturally as seismic energy passes through the Earth.
first arrival	The first recorded *seismic signa*l attributable to a known *seismic source*.
first motion	On a seismogram, the first discernible displacement of the record trace caused by the arrival of a P wave at the seismometer. Upward motion of the ground at the seismometer indicates an expansion in the source region, downward motion indicates a contraction. When the *seismic signal* arrives in the presence of seismic *noise* the proper polarity of the first motion may be difficult to recognize.
f-k	Frequency (f) versus wavenumber (k) analysis that maps the power seismic waves observed at an *array* as function of *azimuth* and *slowness*.
focal depth	A term that refers to the depth of an earthquake hypocenter, i.e., the point where a seismic rupture begins (*focus*).
focal mechanism	See *fault-plane solution*.
focal zone	The rupture zone of an earthquake. In the case of a great earthquake, the focal zone may extend several hundred kilometers in length and several ten kilometers in width.
focus	That point within the Earth from which originates the first displacement of an earthquake and radiation of its elastic waves.
forearc	The region between the trace of the subduction thrust fault and the volcanic chain (volcanic *arc*).
foreshocks	Foreshocks are relatively smaller earthquakes that precede the largest earthquake in a series, which is termed the mainshock. Foreshocks may precede the mainshock by seconds to weeks and usually originate at or near the focus of the larger earthquake. Not all mainshocks have foreshocks.
Fourier spectrum	The relative amplitudes (and phase angles) at different frequencies that are derived from a time history by *Fourier analysis*.
Fourier analysis	The mathematical operation that resolves a time series (for example, a recording of *ground motion*) into a series of numbers that characterize the relative amplitude and phase components of the signal as a function of *frequency*.
frequency	The number of times something happens in a certain *period* of time, such as the *ground shaking* up and down or back and forth during of a seismic wave. The common unit of frequency is Hertz (Hz).

frequency domain	A *seismic signal* that has been recorded in the *time domain* (as a *seismogram*) can be decomposed by means of *Fourier analysis* into its amplitude and phase components as a function of frequency (see *spectrum*). The representations of a seismic signal in the time and in the frequency domain are equivalent in a mathematical sense. For some procedures of data analysis the time-domain representation of a seismic records is more suitable while for others the frequency-domain approach is more appropiate and efficient.
fundamental period	The longest *period* for which an object, e.g., a *seismometer*, a structure, the sub-surface underground or the whole planet Earth shows a maximum response. The reciprocal of *natural frequency*.
G or g	G or g is the force of gravity of the Earth (an acceleration of 9.78 m/s²). When there is an *earthquake*, the forces caused by the shaking can be measured as a fraction or percentage of the force of *gravity* (% g).
Gaussian noise spectrum	The spectrum of a time history whose sample values are generated by random selection from a statistical population that has a specified mean and a standard deviation. The values (ordinates) have a bell-shaped distribution about the mean. In earthquake studies, this type of spectrum is commonly multiplied by a theoretical *earthquake* source *spectrum* to obtain predicted ground-motion spectra for hypothetical earthquakes.
geodesy	The science of determining the size and shape of the Earth and the precise location of points on its surface.
geodetic	Referring to the determination of the size and shape of the Earth and the precise location of points on its surface.
geology	The study of the planet Earth - the materials it is made of, the processes that act on those materials, the products formed, and the history of the planet and its life forms since its origin.
geometrical spreading	The component of reduction in *wave amplitude* due to the radial spreading of seismic energy with distance from a given source.
geomorphology	The study of the character and origin of landforms, such as mountains, valleys, etc.
geophone	A simple *seismometer*, usually a mass-spring system with electrodynamic *transducer*, which has a relative high natural *frequency* (typically between about 5 and 25 Hz) and which is small in size and weight; commonly used in exploration *geophysics*.
geophysics	The study of the Earth and its sub-systems by physical methods.
geotechnical	Referring to the use of scientific methods and engineering principles to acquire, interpret, and apply knowledge of Earth materials for solving engineering problems.
graben	A down-dropped block of the Earth's crust resulting from extension, or pulling, of the *crust*. See also *horst*.
gradient	The rate of change, e.g., of the seismic velocity with depth in the Earth.

gravity	The attraction between two masses, such as the Earth and an object on its surface. Commonly referred to as the acceleration of gravity g. Changes in the gravity field can be used to infer information about the structure of the Earth's lithosphere and upper mantle. Interpretations of changes in the gravity field are generally applied to gravity values corrected for extraneous effects. The corrected values are referred to by various terms, such as free-air gravity, Bouguer gravity, and isostatic gravity, depending on the number and kind of corrections made.
Green's function	A mathematical representation that, in reference to earthquake shaking, is used to represent the *ground motion* caused by instantaneous slip on a small part of a fault. Green's function can be summed over a large fault surface to compute the *ground shaking* for a large earthquake rupturing a fault of finite size. The fractional fault-slip events that are summed can be records from small earthquakes on the fault or they can be theoretically computed small-earthquake records.
ground failure	A general reference to landslides, liquefaction, lateral spreads, and any other consequence of shaking that affects the stability of the ground.
ground motion /shaking	The movement of the Earth's surface from earthquakes, explosions or other seismic *sources*. Ground motion is produced by waves that are generated by sudden *slip* on a *faul*t, the collapse of sub-surface cavities or sudden pressure at the explosive source and travel through the Earth and along its surface.
Gutenberg discontinuity	The seismic velocity discontinuity marking the *core-mantle* boundary (CMB) at which the velocity of P waves drops from about 13.7 km/s to about 8.0 km/s and that of S waves from about 7.3 km/s to 0 km/s. The CMB reflects the change from the solid *mantle* material to the fluid outer *core*.
halfspace	A mathematical model bounded by a planar surface but otherwise infinite. Properties within the model are commonly assumed to be homogeneous and isotropic, unlike the Earth itself, which is heterogeneous and anisotropic. Nevertheless, the half space model is frequently used to perform some theoretical calculations (forward modeling) in seismology.
harmonic tremor	Continuous rhythmic ground vibrations that can be detected by seismographs. Harmonic tremors often precede or accompany volcanic eruptions.
hazard	See *earthquake hazard*.
Hertz (Hz)	The unit of frequency; expressed in cycles per second.
Holocene	Refers to a period of time between present and 10,000 years before present. Applied to rocks or faults, this term indicates the period of rock formation or the time of most recent fault slip. Faults of this age are commonly considered active, based on the observation of historical or *palaeoseismic* activity on faults of this age in other locales.

homogeneous	Being uniform, of the same nature; the opposite of inhomogeneous. Although the real Earth as a whole is largely inhomogeneous and weakly *anisotropic*; the Earth can be considered for *seismic modeling* in a first approximation, at least in parts, as being homogeneous and isotropic.
horst	An upthrown block lying between two steep-angled fault blocks.
hydroacoustic	Pertaining to compressional (sound) waves in water, in particular in the ocean. Hydroacoustic waves may be generated by submarine explosions, volcanic eruptions or earthquakes.
hypocenter	The calculated location of the focus of an earthquake, i.e., of the point within the Earth where an earthquake rupture starts. Also commonly termed the *focus*.
infrasonic	Pertaining to low-frequency (sub-audible) compressional (sound) waves in the atmosphere.
inhomogeneous	The opposite of (see) *homogeneous*.
instrumental noise	See *noise*.
intensity	A measure of the effects of an earthquake at a particular place at the Earth's surface on humans and (or) structures. The intensity at a point depends not only upon the strength of the *earthquake* (magnitude) but also upon the distance from the earthquake to the epicenter, the depth of the hypocenter and the local geology at that point. Several scales exist, most of them giving the intensity in 12 degrees, usually written as Roman numerals. Most frequently used are at present the European Macroseismic Scale (EMS-98), and in the United States the Modified Mercalli scale and the Rossi-Forel scale. There are many different intensity values for one earthquake, depending on how far you are away from the epicenter; this is unlike the magnitude value, which is one number for each earthquake as a measure of the amount of seismic wave energy released by it.
Internet	World-wide network of computers linked by means of the Internet protocol (IP).
interplate / intraplate	Intraplate pertains to processes within the Earth's crustal plates. Interplate pertains to processes between the plates.
interplate coupling	The qualitative ability of a subduction thrust fault to lock and accumulate stress. Strong interplate coupling implies that the fault is locked and capable of accumulation *stress* whereas weak coupling implies that the *fault* is unlocked or only capable of accumulating low stress. A fault with weak interplate coupling could be *aseismic* or could slip by *creep*. See *locked fault*.
isoseismal	Referring to a line on a map bounding points of equal intensity for a particular earthquake.
isoseismal line	A line connecting points on the Earth's surface at which earthquake intensity is the same. It is usually a closed curve around the epicenter.
isotropic	In an isotropic medium the physical properties, e.g., the propagation velocity of seismic waves or the hardness of rock, are independent on the direction considered.
kinematic	Referring to the general movement patterns and directions, usually expressed in physical units of displacement (m) , velocity (m/s) or acceleration (m/s^2).

kinematic units	See *kinematic*.
landslide	The downslope movement of *soil* and/or rock.
Late Quaternary	The age between the present and 500,000 years before the present. Faults of this age are sometimes considered active based on the observation of historical or *palaeoseismic* activity on faults of this age in some locales.
lateral spread and flow	Terms referring to landslides that commonly form on gentle slopes and that have rapid fluid-like flow movement, like water.
least-squares fit	An approximation of a set of data with a curve such that the sum of the squares of the differences between the observed points and the assumed curve is a minimum.
left-lateral movement	See *fault movement*.
lifelines	Structures that are important or critical for a community to function, such as roadways, pipelines, power lines, sewers, communications, and port facilities.
liquefaction	Process by which water-saturated sediment temporarily loses strength and acts as a fluid. This effect can be caused by earthquake shaking and be associated with *sand boil*.
lithology	The description of rock composition (what it is made of) and texture.
lithosphere	The outer solid part of the Earth , including crust and uppermost mantle. The lithosphere is about 100 km thick, although its thickness is age-dependent (older lithosphere is thicker). The lithosphere below the crust is brittle enough at some locations to produce earthquakes by faulting, such as within a subducted oceanic plate.
locked fault	A fault that is not slipping because frictional resistance on the fault is greater than the shear stress across the fault. Such faults may store strain for extended periods that is eventually released in an earthquake when frictional resistance is overcome.
Love wave	A major type of *surface waves* having a horizontal motion that is transverse (or perpendicular) to the direction of propagation. It is named after A. E. H. Love, the English mathematician who discovered it.
leaking mode	A surface seismic wave which is imperfectly trapped, e.g., within a *low-velocity layer* or a sequence of layers so that its energy leaks or escapes across a layer boundary causing some attenuation.
low-velocity layer/zone)	Any layer in the Earth in which seismic wave velocities are lower than in the layers above and below.
Ma	An abbreviation for one million years ago (Megannum).
major earthquake	An earthquake having a magnitude of 7 or greater on the Richter scale.

magnetic reversal	A change of the Earth's magnetic field to the opposite polarity that has occurred at irregular intervals during geologic time. Polarity reversals can be preserved in sequences of magnetized rocks and compared with standard polarity-change time scales to estimate geologic ages of the rocks. Rocks created along the oceanic spreading ridges commonly preserve this pattern of polarity reversals as they cool, and this pattern can be used to determine the rate of ocean-ridge spreading. The reversal patterns recorded in the rocks are termed sea-floor magnetic lineaments.
magnification curve	A diagram showing the dependence of *amplification*, e.g. of the seismic *ground motion* by a *seismograph*, as a function of *frequency*.
magnitude	A number that characterizes the relative size of an *earthquak*e. Magnitude is based on measurement of the maximum motion recorded by a seismograph (sometimes for waves of a particular frequency), corrected for the attenuation with distance. Several scales have been defined, but the most commonly used are (1) local magnitude (Ml or ML), commonly referred to as "Richter magnitude", (2) surface-wave magnitude (Ms), (3) body-wave magnitude (mb), and (4) moment magnitude (Mw). The magnitude 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 earthquake sizes but is more difficult to compute than the other types. In principal, all magnitude scales could be cross calibrated to yield the same value for any given earthquake, but this expectation has proven to be only approximately true, thus the need to specify the magnitude type as well as its value.
mainshock	The largest earthquake in a sequence, sometimes preceded by one or more *foreshocks*, and almost always followed by many *aftershocks*.
mantle	The part of the Earth's interior between the *core* and the *crus*t.
microearthquake	An *earthquake* that is not perceptible by man and can be recorded by seismographs only. Typically, a microearthquake has a magnitude of 2 or less on the Richter scale.
microseism	A more or less continuous motion in the Earth in a wide *frequency* range that is unrelated to any earthquake and caused by a variety of usually uncorrelated (incoherent) natural and artificial (man-made) sources. More specifically that part of seismic *noise* that is generated by wave motions on lakes and oceans and their action on shores, typically with periods between about 2 to 9 (the stronger secondary microseisms), and 11 to 18 seconds (the weaker primary microseisms).
microzonation	The identification and mapping at local or site scales of areas having different potentials for hazardous earthquake effects, such as *ground shaking intensity*, *liquefaction* or *landslide* potential.
MM scale	Mercalli intensity scale modified for North American conditions.

Moho	The abridged name for the *Mohorovičić discontinuity*.
Mohorovičić discont.	A discontinuity in seismic velocities that defines the boundary between crust and mantle of the Earth. Named after the Croation seismologist Andrija Mohorovičič (1857-1936) who discovered it. The boundary is between 20 and 60 km deep beneath the continents and between 5 and 10 km deep beneath the ocean floor.
moment magnitude	See *magnitude*
monitoring system	A system for monitoring earthquakes, volcanic eruptions, tsunami, and/or other phenomena, usually consisting of a network of *seismic stations* and/or *arrays*, sometimes complemented by other types of sensors.
moveout	The time difference between like *arrivals* (such as P) at different stations, or between different arrivals at the same stations (like P and pP), which is also known as step-out.
natural frequency	The discrete frequency at which a particular elastic object or system vibrates when it is set in motion by a single impulse and not influenced by other external forces or damping. The reciprocal of *fundamental period*.
Newmark analysis	A numerical technique that models a potential landslide as a rigid block resting on a frictional slope, describing dynamic forces on the block from assumed *ground shaking* records in order to calculate the expected displacement of the block.
noise	Incoherent natural or artificial perturbations caused by a diversity of agents and distributed sources. One usually differentiates between ambient background noise and instrumental noise. The former is due to natural (ocean waves, wind, rushing waters, animal migration, ice movement, etc) and/or man-made sources (traffic, machinery, etc.), whereas instrumental (internal) noise may be due to the "flicker" noise of electronic components and/or even Brownian molecular motions in mechanical components. Digital data acquisition systems may add digitization noise due to their finite discrete resolution (least significant digit). Very sensitive seismic recordings may contain all these different noise components, however, usually their resolution is chosen so that only *seismic signals* and to a certain degree also the ambient *noise* are resolved. Disturbing noise can be reduced by selecting recording sites remote from noise sources, installation of seismic sensors underground (e.g., in boreholes, tunnels or abandoned mines) or by suitable filter procedures (improvement of the *signal-to-noise ratio*).
normal stress	That stress component that acts perpendicular to a given plane.
Nyquist frequency	Half of the digital sampling rate. It is the minimum number of counts per second needed to define unambiguously a particular frequency. If the *seismic signal* contains energy in a frequency range above the Nyquist frequency the signal distortions are called aliasing.
oceanic spreading ridge	A fracture zone along the ocean bottom that accommodates upwelling of mantle material to the surface, thus creating new crust. A line of ridges, formed as molten rock reaches the ocean bottom and solidifies, topographically mark this fracture.

oceanic trench	A linear depression of the sea floor caused by and approximately coincident with a subduction thrust fault.
octave (filtering)	In music, the eighth full tone above (or below) a given tone having twice (or half) as many vibrations per second, e.g., the "concert pitch" a^1 has a *frequency* of 440 Hz, while the tone a^2, which is one octave higher, has a frequency of 880 Hz. S*eismographs* typically record (filter) *ground motion* oscillations within a range of one (narrow-band) to 12 octaves (very broadband).
oscillator	A mass that moves with oscillating motion under the influence of external forces and one or more forces that restore the mass to its stable at-rest position. In earthquake engineering, an oscillator is an idealized damped mass-spring system used as a model of the response of a structure to earthquake *ground motion*. A seismograph is also an oscillator of this type.
onset	The first appearance of an acoustic or *seismic signal* on a record.
origin time	Time of a seismic, hydroacoustic, or infrasonic *even*t.
outer arc ridge	A zone landward from the trace of the subduction thrust fault of elevated sea floor probably related to the compression of the rocks in the *accretionary wedge*. Also referred to as the outer arc high.
palaeoseismic	Referring to the prehistoric seismic record as inferred from ruptural displacements in young geologic sediments in combination with *$_{14}C$ age* dating.
parameter (data)	A quantitative attribute of a seismic *arriva*l, such as *onset* or *arrival time*, *azimuth*, *slowness*, *period*, and *amplitude*.
Peak ground acceleration	The PGA relates to the maximum *acceleration amplitude* measured (or expected) in a strong-motion *accelerometer* record of an *earthquake*.
pedogenic	Pertaining to processes that add, transfer, transform, or remove *soil*.
period	The average duration of one cycle of a periodic motion, in seconds per cycle.
phase	(1) A stage in periodic motion, such as wave motion or the motion of an oscillator, measured with respect to a given initial point and expressed in angular measure. (2) A pulse of seismic energy arriving at a definite time, which passed the Earth on a specific path. (3) Stages in the physical properties of rocks or minerals under differing conditions of pressure, temperature, and water content.
Pleistocene	The time period between about 10,000 years before present and about 1,650,000 years before present. As a descriptive term applied to rocks or *faults*, it marks the period of rock formation or the time of most recent fault slip, respectively. Faults of Pleistocene age may be considered active though their activity rates are commonly lower than for younger faults.
Poisson distribution	A probability distribution that characterizes discrete events occurring independently of one another in time.
polarity	In *seismology* the direction of *first motion* on a *seismogram*, either up (compression) or down (dilatation or relaxation).

polarity reversal	The occurrence of *waveforms* that are mirror images of their related initial phases, e.g., the waveforms of depth phases with respect to their primary P- or S-type phases.
polarization	The shape and orientation in space of the ground-motion particle trajectory. It differs for different types of seismic waves such as P, S and *surface waves* and may be ± linear or elliptical, prograde or retrograde. It is also influenced by heterogeneities and *anisotropy* of the medium in which the seismic waves propagate and depends on their *frequency* or *wavelength*, respectively. The polarization of *ground motion* may be reconstructed by analyzing three-component seismic recordings.
primary seismic station	IMS seismic station or array that is part of the detection network to monitor the CTBT.
P wave	A seismic body wave that involves particle motion (alternating compression and extension) in the direction of propagation. P waves travel faster than *S waves* and, therefore, arrive earlier in the record of a seismic event (P stands for "unda prima" = primary wave).
Quaternary	The geologic time period comprising about the last 1.65 million years.
radiation pattern	Dependence of the *amplitudes* of seismic *P* and *S waves* on the direction and take-off angle under which their *seismic rays* have left the *seismic sour*ce. It is controlled by the type of source mechanism, e.g. , the orientation of the earthquake *fault plane* and *slip* direction in space.
radiometric	Pertaining to the measurement of geologic time by the analysis of certain radioisotopes in rocks and their known rates of decay (see $_{14}C$ *age date*).
Rayleigh wave	A seismic surface wave causing a retrograde, elliptical motion of a particle at the free surface, with no transverse motion. It is named after Lord Rayleigh (1842-1919), who predicted its existence.
ray theory	Theoretical approach, which treats wave propagation as the propagation of *seismic rays*. It is an approximation, which yields good results for short wave length (high-frequency approximation) and allows easy calculations of travel times.
ray-tracing method	Computational method of calculating ground-shaking estimates that assumes that the *ground motion* is composed of multiple arrivals of *seismic rays* and related energy bundles (Gauss beams) that leave the source and are reflected or refracted at velocity boundaries according to Snell's Law. The amplitudes of reflected and refracted waves at each boundary are recalculated according to the Law of Conservation of Energy.
recurrence interval	The average time span between large earthquakes at a particular site. Also termed "return period".
reference channel	The array element to which the station's timing is referenced with respect to its other elements, and thereby reflecting the timing of the array as a whole. It is typically either the element at the center of a circular *array*, or the element at the intersection of a cross-shaped array.

reflection	The energy or wave from a *seismic source* that has been returned (reflected) from an interface between materials of different elastic properties within the Earth, just as a mirror reflects light.
reflector	An interface between materials of different elastic properties that reflects seismic waves.
refraction	(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.
regression analysis	A statistical technique applied to data to determine, for predictive purposes, the degree of correlation of a dependent variable with one or more independent variables, in other words, to see if there is a strong or weak cause-and-effect relationship between two or more parameters.
relaxation theory	A concept in which radiated seismic energy is released from stored strain energy during the slip along a fault until the adjacent fault blocks reach a new state of equilibrium.
return period	See *recurrence interval*.
residual	The difference between the measured and predicted values of some quantity.
resonance	Strong increase in the amplitude of vibration in an elastic body or system when the frequency of the shaking force is close to one or more times of the natural frequencies of a shaking body.
response	The motion in a system resulting from shaking under specified conditions.
response spectrum	A curve showing the computed maximum response of a set of simple damped harmonic oscillators of different natural frequency to a particular record of ground acceleration. Response spectra, commonly plotted on tripartite logarithmic graph paper, show the oscillator's maximum acceleration, velocity, and displacement as a function of oscillator frequency for various levels of oscillator's damping. A computational approximation to the response spectrum is referred to as the pseudo-relative velocity response spectrum (PSRV). These curves are used by engineers to estimate the maximum response of simple structures to complex *ground motion*s.
reverse movement	See *fault movement*.
rheological properties	The properties of rocks that describe their ability to deform and flow as a function of temperature, pressure, and chemical conditions.
right-lateral movement	See *fault movement*.
Ring of Fire	The zone of volcanoes and earthquakes surrounding the Pacific Ocean which is called the *Circum-Pacific belt*; about 90% of the world's earthquakes occur there. The next most seismic region (5 – 6 % of earthquakes) is the *Alpide belt*.
root mean square	Square root of the mean value of a set of squared values.
run-up height	The maximum height of a tsunami wave when running into shallow waters near the coast; see *tsunami*.

rupture front	The instantaneous boundary between the slipping and locked parts of a fault during an earthquake. Rupture in one direction on the fault is referred to as unilateral. Rupture may radiate outward in a circular manner or it may radiate toward the two ends of the fault from an interior point, behavior referred to as bilateral.
rupture velocity	The speed at which a rupture front moves across the surface of the fault during an earthquake.
S wave	A seismic body wave that involves a shearing motion in the direction perpendicular to the direction of wave propagation. When it is resolved into two orthogonal components in the plane perpendicular to the direction of propagation, SH denotes the horizontal component and SV denotes the vertical component.
sand boil	Sand and water ejected to the ground surface during strong earthquake shaking as a result of *liquefaction* at shallow depth; the conical sediment deposit remains as evidence of liquefaction.
sea-floor spreading	See *magnetic polarity reversals*.
secular	Referring to long-term changes that take place slowly and imperceptibly. Commonly used to describe changes in elevation, tilt, and stress or strain rates that are related to long-term tectonic deformation. For example, a mountain that is growing is getting taller so slowly that we cannot see it happen, but if we measure the elevation in one year and then after, e.g., another time ten years later, we could see that it has grown taller.
segmentation	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 maximum possible seize of an earthquake on that fault.
seiche	Oscillation of the surface of an enclosed body of water owing to earthquake shaking. Lakes and swimming pools often have seiches during strong earthquakes.
seismic belt	An elongate earthquake zone, for example, the Circum-Pacific, Mediterranean, Rocky Mountains earthquake belt.
seismic constant	In building codes dealing with *earthquake hazard*, an arbitrarily set quantity of steady acceleration (in units of gravity g) that a building must withstand.
seismic event	General term for localized sources of different type which generate *seismic waves*.
seismic gap	A section of fault that has produced earthquakes in the past but is now quiet. For some seismic gaps, no earthquakes have been observed historically, but it is believed (on some other basis, such as plate-motion information or strain measurements) that the fault segment is capable of producing earthquakes. A long-term seismic gap may give hint to the most probable location of another strong earthquake in the future.
seismic hazard	See *earthquake hazard*.
seismic impedance	Seismic wave velocity multiplied by density of the medium.

seismicity	The geographic and historical distribution of earthquakes.
seismic moment	A measure of the size of an earthquake based on the area of fault rupture, the average amount of slip, and the force that was required to overcome the friction sticking the rocks together that were offset by faulting. Seismic moment can also be calculated from the amplitude spectra of seismic waves.
seismic ray	Vector perpendicular to the wave front pointing into the direction of wave propagation and marking behind it the "ray trace". The propagation of *seismic waves* can be easily modeled as the propagation of seismic rays following Snell's Law. This assumption is a reasonable approximation for high frequency waves.
seismic line	A set of seismographs usually lined up along the Earth's surface to record seismic waves generated by an explosion or by vibrators for the purpose of recording reflections and/or refractions of these waves from velocity discontinuities within the Earth. The data collected can be used to infer the internal structure of the Earth.
seismic risk	The probability of social or economic consequences of an earthquake.
seismic recorder	Devise for recording seismic *ground motions* in analog or digital form (see *seismogram*), usually as a frequency-filtered and amplified equivalent electronic signal (see *transducer* and *data logger*).
seismic signal	A *coherent* transient *waveform* radiated from a definite, localized *seismic source* that is usually considered as an useful signal for the location of the source, the analysis of the source process and/or of the propagation medium (in contrast to *noise*)..
seismic sensor	There are two basic types of seismic sensors: inertial *seismometers* which measure ground motion relative to an inertial reference (a suspended mass), and *strainmeters* or extensometers which measure the motion of one point of the ground relative to another. Inertial seismometers are generally more sensitive to earthquake signals whereas strainmeters may outperform inertial seismometers when observing very long-period free oscillations of the Earth, tidal motions, and quasi-static deformations when it becomes increasingly difficult to maintain an inertial reference.
seismic source	A localized area or volume generating *coherent*, usually *transient* seismic *waveforms*, such as an *earthquake*, *explosion*, vibrator etc.
seismic station	See *station*.
seismic wave	An elastic wave generated by an impulse such as an earthquake or an explosion. Seismic waves may travel either along or near the Earth's surface (*Rayleigh* and *Love waves*) or through the Earth's interior (P and S *body waves*).
seismic zonation	Geographic delineation of areas having different potentials for hazardous effects from future earthquakes. Seismic zonation can be done at any scale - national, regional, local or site, the latter two often referred to as *microzonation*.
seismic zone	An area of seismicity probably sharing a common cause.

seismogenic	Capable of generating earthquakes.
seismogram	A record written by a seismograph in response to *ground motion*s produced by an earthquake, explosion, or other sources that generate oscillating ground motions. Such a record may analog or digital.
seismograph	See *seismometer*.
seismology	The study of earthquakes and the structure of the Earth, by both naturally and artificially generated seismic waves.
seismometer	A seismometer is usually a damped oscillating mass that is connected with a fixed base and frame via a suspension, e.g., a spring. Such a damped mass-spring system is used to detect and measure seismic *ground motion* relative to the suspended mass which serves as an inertial reference. The motion of the base, which is fixed to the ground, with respect to the suspended mass is commonly transformed into an electrical voltage (see *transducer*). The electrical voltage is recorded on paper, magnetic tape, or another recording medium. This record, which may be analog or digital, is proportional to the relative motion, the velocity or the *acceleration* of the seismometer mass with respect to the ground on which the seismometer is installed, but it can be mathematically converted to a record of the absolute motion of the ground. Another type of seismometers are *strainmeters*. Seismograph is a term that refers to the seismometer as the *sensor* of the motion together with its recording device as a unit.
separation	The distance between any two parts of a reference plane (for example, a sedimentary bed or a geomorphic surface) offset by a fault, measured in any plane. Separation is the apparent amount of fault displacement and is nearly always less than the actual slip.
shear modulus	The ratio of shear stress to shear strain of a material during simple shear.
shear stress	The stress component parallel to a given surface, such as a fault plane, that results from forces applied parallel to the surface or from remote forces transmitted through the surrounding rock.
shear wave	See *S wave*.
signal	See *seismic signal*.
signal-to-noise ratio	The comparison between the *amplitude* of the *seismic sign*al and the amplitude of the *noise*; abbreviated as SNR.
signature	The appearance of a seismic signal that is more or less unique to the kind of *seismic source*.
slab	In the context of the Manual the oceanic crustal plate that underthrusts the continental plate in a subduction zone and is consumed by the Earth's *mantle*.
slab pull	The force of gravity causing the cooler and denser oceanic slab to sink into the hotter and less dense mantle material. The downdip component of this force leads to downdip extensional stress in the slab and may produce earthquakes within the subducted slab. Slab pull may also contribute to stress on the subduction thrust fault if the fault is locked.

slickensides	Polished striated rock surfaces caused by one rock mass moving across another one on a fault.
slip	The relative *displacement* of formerly adjacent points on opposite sides of a fault.
slip model	A *kinematic* model that describes the amount, distribution, and timing of a slip associated with an earthquake.
slip rate	How fast the two sides of a fault are slipping relative to one another, as derived from seismic records in case of an earthquake or determined, as a long-term average, from geodetic measurements, from offset man-made structures, or from offset geologic features whose age can be estimated. It is measured parallel to the predominant slip direction or estimated from the vertical or horizontal offset of geologic markers.
slowness	The inverse of velocity, given in the unit seconds/degree or s/km; a large slowness corresponds to a low velocity.
soil	(1) In engineering, all unconsolidable material above the *bedrock*. (2) In soil science, naturally occurring layers of mineral and (or) organic constituents that differ from the underlying parent material in their physical, chemical, mineralogical, and morphological character because of *pedogenic* processes.
soil profile	Vertical arrangement of soil horizons down to the parent material or to *bedrock*. Commonly subdivided into A, B and C horizons.
source	See *seismic source*.
source depth	Depth of an earthquake *hypocenter* (see *focal depth*) or of a buried explosion, mining collapse, or any other type of *source* that generates seismic waves.
source function	The *ground motion* generated at the *fault* during rupture, usually as predicted by a theoretical model and represented by a time history or *spectrum*. The terms Brune spectrum, Aki spectrum, and Haskel model refer to varying representations of the source function, each based on different assumptions, as devised by the scientist for which the model is named.
spectral acceleration	Commonly refers to either the *Fourier amplitude spectrum* of ground *acceleration* or the *PSRV*; abbreviated as SA.
spectral amplification	A measure of the relative shaking response of different geologic materials depending on the frequency of excitation; the ratio of the *Fourier amplitude spectrum* of a *seismogram* recorded on one material to that computed from a seismogram recorded on another material for the same *earthquake* or explosion.
spectrum	Curves showing *amplitude* and *phase* of a *time-history* as a function of *frequency* or *period*.
spread	The layout of *seismometer*/*geophone* groups from which data from a single shot (the explosive charge) or vibrator sweep are recorded simultaneously.
standard deviation	A measure of how much a set of data is different from the curve it should make when plotted on a graph. Or, the square root of the average of the squares of deviations about the mean of a set of data. Standard deviation is a statistical measure of spread or variability.

station	The site where geophysical instruments, e.g., *seismograph*s, have been installed for observations. Stations can either be single sites or *arrays*.
Step-out	The time between two seismic *phases*, such as pP and P, at a specific epicentral distance of a *station*. The step-out, if it increases or decreases as the distance increases, can be a characteristic determinant for phase identification.
stick-slip	The rapid displacement that occurs between two sides of a *fault* when the shear *stress* on the fault exceeds the frictional stress. Also a jerky, sliding type of motion associated with *fault movement* in laboratory experiments. It may be a mechanism in shallow *earthquakes*. Stick -slip displacement on a fault radiates energy in the form of *seismic waves*.
stochastic	Applied to processes that have random characteristics.
strain	Small changes in length, volume or shape associated with deformation of the Earth by tectonic stresses or by the passage of seismic waves.
strainmeter	Strainmeters or extensometers are another basic type of *seismic sensors*. They measure the motion of one point of the ground relative to another, in contrast to inertial *seismometers* which measure the *ground motion* relative to an inertial reference such as a suspended mass.
strain rate	Strain measurements are computed from observed changes in length on the Earth's surface, commonly along multiple paths. Because the changes in length are observed over varying time periods and path lengths, they are expressed as the change in length divided by the measurement distance divided by the time period of measurement. This number, which is expressed as the change in length per unit length per unit time, is termed the strain rate. These measurements are used to infer the directions of principal strain and stress rates near the Earth's surface.
stratigraphy	The study of the character, form, and sequence of layered rocks.
stress	Force per unit area acting on a plane within a body. Six values are required to characterize completely the stress at a point in a *homogeneous, isotropic* medium: three normal components and three shear components.
stress drop	The difference between the stress on a fault before and after an earthquake. A parameter in many models of the earthquake source that has a bearing on the level of high-frequency shaking radiated by the earthquake. Commonly stated in units termed bars or megapascals (1 megapascal (MPa) = 10^6 N/m^2 = 10 bars).
strike	Trend or bearing, relative to north, of the line defined by the intersection of a planar geologic surface (for example, a fault or a bed) and a horizontal surface such as the ground.
strike-slip	See *fault movement*.
strong motion	*Ground motion* of sufficient *amplitude* and duration to be potentially damaging to a building's structural components or architectural features.

subduction	A plate tectonics term for the process whereby the oceanic lithosphere collides with and descends beneath the continental lithosphere.
subduction thrust fault	The fault that accommodates the differential motion between the downgoing oceanic crustal plate and the continental plate. This *fault* is the contact between the top of the oceanic plate and the bottom of the newly formed continental *accretionary wedge*. Also alternately referred to as the plate-boundary thrust fault, the thrust interface fault, or the megathrust fault.
subduction zone	An elongate region along which a block of crust descends relative to another crustal block, for example, the descend of the Pacific plate beneath the Andean plate along the Andean trench.
surface faulting	Displacement that reaches the Earth's surface during slip along a fault. Commonly accompanies moderate and large earthquakes having focal depths less than 20 km. Surface faulting also may accompany *aseismic* tectonic creep or natural or man-induced subsidence.
surface wave	Seismic wave that travels along or near to the Earth's surface. *Love* and *Rayleigh waves* are the most common.
S wave	A seismic *body wave* that involves a shearing *ground motion* (without volume change) perpendicular (transverse) to the direction of wave propagation. S waves travel slower than *P waves*. Accordingly, they arrive later in the *seismic record* of a *seismic event* (S stands for "unda secunda" = secondary wave).
tectonic	Refers to rock-deforming processes and resulting structures such as folds or faults that occur over large sections of the lithosphere.
tectonic plates	Large, relatively rigid plates of the *lithosphere* that move relative to one another on the outer surface of the Earth.
teleseism	A *seismic source* that is distant (more than about 2000 km away) from the recording station.
teleseismic	Pertaining to a seismic source at distances greater than about 2000 km from the measurement site.
tensional stress	The stress that tends to pull something apart. It is the stress component perpendicular to a given surface, such as a fault plane, that results from forces applied perpendicular to the surface or from remote forces transmitted through the surrounding rock.
theoretical onset	The point where an *arrival* is expected to appear on a *seismic record*, based on the known location and depth of the *seismic source*.
thrust fault	See *fault*.
tilt	An observed change in the slope of the Earth's surface.
time domain	A seismic record is usually presented in the time domain, i.e., as a display of varying amplitudes of (filtered) *ground motion* as a function of time (in contrast to the equivalent representation in the *frequency domain*) (see also *Fourier analysis*).
time history	The sequence of values of any time-varying quantity (such as a *ground motion* measurement) measured at a set of fixed times. Also termed time series.
timing error	A deviation from absolute time, as measured from a station.

transducer	Any of various devices that transmit energy from one system to another, sometimes one that converts the energy in form. For recording seismic *ground motion* the motion of the *seismometer* mass has to be transmitted either via a mechanical or optical lever system to the recorder (used in old classical *seismographs*) or to be converted into an equivalent electronic signal (as used in all modern seismometers). Transducers use different physical principles and devices such as coil-magnet systems, iductive bridges, capacity half-bridges, pieco-electric effects, interferometric-optical devices, etc. Accordingly, the output signal of the transducer may be proportional to ground *displacement*, *velocity* or *acceleration*.
transfer function	The transfer function of a seismic sensor-recorder sytem (or of the Earth medium through which seismic waves propagate) describes the frequency-dependent amplification, damping and phase distortion of seismic signals by a specific sensor-recorder (or medium). The modulus (real term = absolute value) of the transfer function is termed the frequency response function or *magnification curve*, e.g. of a *seismograph*.
transform fault	A special variety of strike-slip fault that accommodates relative horizontal slip between other tectonic elements, such as oceanic crustal plates. Often extend from oceanic ridges.
travel time	The time required for a wave traveling from its source to a point of observation.
travel-time curve	A graph of arrival times, commonly of direct as well as multiply reflected and converted P or S waves, recorded at different points as a function of distance from the *seismic source*. Seismic velocities within the Earth can be computed from the slopes of the resulting curves.
tsunami	An impulsively generated sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major submarine slides, or exploding volcanic islands. When running into shallow waters near the coast the tsunami wave front, the “bore”, sometimes piles up the waters 30 m or higher and sweeps up to several km into shallow land. The run-up height strongly depends on coastal profile and shape. Bays and cone-shaped river mouths increase run-up heights.
tsunamigenic	Referring to those earthquake sources, commonly along major subduction-zone plate boundaries such as those bordering the Pacific Ocean, that can generate tsunamis.
tsunami magnitude	A number used to compare sizes of tsunamis generated by different *earthquakes*; calculated from the logarithm of the maximum amplitude of the tsunami wave measured by a tide gauge distant from the tsunami source.
turbidite	Sea-bottom deposit formed by massive slope failures of large sedimentary deposits. These slopes fail in response to, e.g., earthquake shaking or excessive sedimentation load.
UNIX	A widely used operating system installed on many different workstations.
universal time (UT)	The absolute time using Greenwich Mean Time as reference.

velocity	In reference to earthquake shaking, velocity is the time rate of change of ground displacement of a reference point during the passage of earthquake seismic waves, commonly expressed in nanometer or micrometer per second. However, velocity may also refer to the speed of propagation of seismic waves through the Earth, commonly expressed in kilometers per second.
velocity structure	A generalized local, regional or global model of the Earth that represents its structure in terms of the velocities of propagation of *P* and/or *S waves*.
Wadati-Benioff zone	A dipping planar (flat) zone of earthquakes that is produced by the interaction of a downgoing oceanic crustal plate with a continental plate. These earthquakes can be produced by slip along the *subduction* thrust fault (thrust interface between the continental and the oceanic plate) or by slip on faults within the downgoing plate as a result of bending and extension as the plate is pulled into the *mantle*. Slip may also initiate between adjacent segments of downgoing plates. Wadati-Benioff zones are usually well developed along the trenches of the Circum-Pacific belt, dipping towards the continents.
water table	The upper surface of a body of unconfined ground water at which the water pressure is equal to the atmospheric pressure.
waveform (data)	The complete analog or sufficiently dense sampled digital representation of a continuous wave group (e.g.,of a seismic *phase*) or of a whole wave train (*seismogram*). Accordingly, waveform data allow to reconstruct and analyse the whole seismic phase or earthquake record both in the *time* and *frequency dom*ain whereas *parameter data* describe the signal only by a very limited number of more or less representative measurements such as *onset time*, maximum signal *amplitude* and related *period*.
wave front	The surface formed by all elements of a propagating wave, which swing “in phase”; the wave front is perpendicular to the *seismic rays*, which are oriented in direction of wave propagation.
wavelength	The distance between successive points of equal amplitude and phase on a wave (for example, crest to crest or trough to trough).