Natural disaster – earthquakes

Environment, Natural Disaster

Earthquake, shaking of the Earth’s surface caused by rapid movement of the Earth’s rocky outer layer. Earthquakes occur when energy stored within the Earth, usually in the form of strain in rocks, suddenly releases. This energy is transmitted to the surface of the Earth by earthquake waves. The destruction an earthquake causes depends on its magnitude and duration, or the amount of shaking that occurs. A structure’s design and the materials used in its construction also affect the amount of damage the structure incurs. Earthquakes vary from small, imperceptible shaking to large shocks felt over thousands of kilometers.

Earthquakes can deform the ground, make buildings and other structures collapse, and create tsunamis (large sea waves). Lives may be lost in the resulting destruction. In the last 500 years, several million people have been killed by earthquakes around the world, including over 240, 000 in the 1976 T’ang-Shan, China, earthquake. Worldwide, earthquakes have also caused severe property and structural damage. Adequate precautions, such aseducation, emergency planning, and constructing stronger, more flexible, safely designed structures, can limit the loss of life and decrease the damage caused by earthquakes.

Focus and Epicenter- The point within the Earth along the rupturing geological fault where an earthquake originates is called the focus, or hypocenter. The point on the Earth’s surface directly above the focus is called the epicenter. Faults-Stressin the Earth’s crust creates faults, resulting in earthquakes. The properties of an earthquake depend strongly on the type of fault slip, or movement along the fault, that causes the earthquake. Geologists categorize faults according to the direction of the fault slip.

The surface between the two sides of a fault lies in a plane, and the direction of the plane is usually not vertical; rather it dips at an angle into the Earth. Waves- The sudden movement of rocks along a fault causes vibrations that transmit energy through the Earth in the form of waves. Waves that travel in the rocks below the surface of the Earth are called body waves, and there are two types of body waves: primary, or P, waves, and secondary, or S, waves. The S waves, also known as shearing waves, move the ground back and forth Effects Of Earthquake

Ground Shaking and Landslides-Earthquake waves make the ground move, shaking buildings and causing poorly designed or weak structures to partially or totally collapse. The ground shaking weakens soils and foundation materials under structures and causes dramatic changes in fine-grained soils. During an earthquake, water-saturated sandy soil becomes like liquid mud, an effect called liquefaction. Liquefaction causes damage as the foundation soil beneath structures and buildings weakens. Fire-Another post-earthquake threat is fire, such as the fires.

The amount of damage caused by post-earthquake fire depends on the types of building materials used, whether water lines are intact, and whether natural gas mains have been broken. Ruptured gas mains may lead to numerous fires, and fire fighting cannot be effective if the water mains are not intact to transport water to the fires. Tsunami Waves and Flooding- Along the coasts, sea waves called tsunamis that accompany some large earthquakes centered under the ocean can cause more death and damage than ground shaking.

Tsunamis are usually made up of several oceanic waves that travel out from the slipped fault and arrive one after the other on shore. They can strike without warning, often in places very distant from the epicenter of the earthquake. Tsunami waves are sometimes inaccurately referred to as tidal waves, but tidal forces do not cause them. Rather, tsunamis occur when a major fault under the ocean floor suddenly slips. The displaced rock pushes water above it like a giant paddle, producing powerful water waves at the ocean surface.

The ocean waves spread out from the vicinity of the earthquake source and move across the ocean until they reach the coastline, where their height increases as they reach the continental shelf, the part of the Earth’s crust that slopes, or rises, from the ocean floor up to the land. Disease- Catastrophic earthquakes can create a risk of widespread disease outbreaks, especially in underdeveloped countries. Damage to water supply lines, sewage lines, and hospital facilities as well as lack of housing may lead to conditions that contribute to the spread of contagious diseases, such as influenza (the flu) and other viral infections.

Blizzard Blizzard, severe storm characterized by extreme cold, strong winds, and a heavy snowfall. These storms are most common to the western United States but sometimes occur in other parts of the country. According to the U. S. National Weather Service, winds of 35 mph (56. 3 km/h) or more and visibility of 0. 25 mi (0. 40 km) or less are conditions that, if they endure for three hours, define a blizzard. The great blizzard of March 11-14, 1888, which covered the eastern U. S. , was perhaps the most paralyzing of any storm on record.

Cyclone Cyclone, in strict meteorological terminology, an area of low atmospheric pressure surrounded by a wind system blowing, in the northern hemisphere, in a counterclockwise direction. A corresponding high-pressure area with clockwise winds is known as an anticyclone. In the southern hemisphere these wind directions are reversed. Cyclones are commonly called lows and anticyclones highs. The term cyclone has often been more loosely applied to a storm and disturbance attending such pressure systems, particularly the violent tropical hurricane and the typhoon, which center on areas of unusually low pressure.

Hurricane Hurricane, name given to violent storms that originate over the tropical or subtropical waters of the Atlantic Ocean, Caribbean Sea, Gulf of Mexico, or North Pacific Ocean east of the International Date Line. Such storms over the North Pacific west of the International Date Line are called typhoons; those elsewhere are known as tropical cyclones, which is the general name for all such storms including hurricanes and typhoons. These storms can cause great damage to property and loss of human life due to high winds, flooding, and large waves crashing against shorelines.

How Hurricanes Form-Tropical cyclones form and grow over warm ocean water, drawing their energy from latent heat. Latent heat is the energy released when water vapor in rising hot, humid air condenses into clouds and rain. As warmed air rises, more air flows into the area where the air is rising, creating wind. The Earth’s rotation causes the wind to follow a curved path over the ocean (the Coriolis effect), which helps give tropical cyclones their circular appearance. Hurricanes and tropical cyclones form, maintain their

strength, and grow only when they are over ocean water that is approximately 27°C (80°F).

Such warmth causes large amounts of water to evaporate, making the air very humid. This warm water requirement accounts for the existence of tropical cyclone seasons, which occur generally during a hemisphere's summer and autumn. Because water is slow to warm up and cool down, oceans do not become warm enough for tropical cyclones to occur in the spring. Oceans can become warm enough in the summer for hurricanes to develop, and the oceans also retain summer heat through the fall.

Hurricanes weaken and die out when cut off from warm, humid air as they move over cooler water or land but can remain dangerous as they weaken. Hurricanes and other tropical cyclones begin as disorganized clusters of showers and thunderstorms. When one of these clusters becomes organized with its winds making a complete circle around a center, it is called a tropicaldepression. When a depression's sustained winds reach 63 km/h (39 mph) or more, it becomes a tropical storm and is given a name. By definition, a tropical storm becomes a hurricane when winds reach 119 km/h (74 mph) or more.

Characteristics of Hurricane-A hurricane consists of bands of thunderstorms that spiral toward the low-pressure center, or " eye" ofthe storm. Winds also spiral in toward the center, speeding up as they approach the eye. Large thunderstorms create an " eye wall" around the center where winds are the strongest. Winds in the eye itself are nearly calm, and the sky is often clear. Air pressures in the eye at the surface range from around 982 hectopascals (29 inches of mercury) in a weak hurricane to lower than 914 hectopascals

(27 inches of mercury) in the strongest storms. Hectopascals are the metric unit of air pressure and are the same as millibars, a term used by many weather forecasters in the United States. Hectopascals is the preferred term in scientific journals and is being used more often in public forecasts in nations that use the metric system.)In a large, strong storm, hurricane-force winds may be felt over an area with a diameter of more than 100 km (60 m). The diameter of the area affected by gale winds and torrential rain can extend another 200 km (120 m) or more outward from the eye of the storm.

The diameter of the eye may be less than 16 km (10 m) in a strong hurricane to more than 48 km (30 m) in a weak storm. The smaller the diameter of the eye, the stronger the hurricane winds will be. A hurricane's strength is rated from Category 1, which has winds of at least 119 km/h (74 mph), to Category 5, which has winds of more than 249 km/h (155 mph). These categories, known as the Saffir-Simpson hurricane scale, were developed in the 1970s. Tornado Tornado, violently rotating column of air extending from ithin a thundercloud down to ground level. The strongest tornadoes may sweep houses from their foundations, destroy brick buildings, toss cars and school buses through the air, and even lift railroad cars from their tracks. Tornadoes vary in diameter from tens of meters to nearly 2 km (1 mi), with an average diameter of about 50 m (160 ft). Most tornadoes in the northern hemisphere create winds that blow counterclockwise around a center of extremely low atmospheric pressure. In the southern hemisphere the winds generally blow clockwise.

Peak wind speeds can range from near 120 km/h (75 mph) to almost 500 km/h (300 mph). The forward motion of a tornado can range from a near

standstill to almost 110 km/h (70 mph). A tornado becomes visible when a condensation funnel made of water vapor (a funnel cloud) forms in extreme low pressures, or when the tornado lofts dust, dirt, and debris upward from the ground. A mature tornado may be columnar or tilted, narrow or broad—sometimes so broad that it appears as if the parent thundercloud itself had descended to ground level. Some tornadoes resemble a swaying elephant's trunk.

Others, especially very violent ones, may break into several intense suction vortices—intense swirling masses of air—each of which rotates near the parent tornado. A suction vortex may be only a few meters in diameter, and thus can destroy one house while leaving a neighboring house relatively unscathed. Formation-Many tornadoes, including the strongest ones, develop from a special type of thunderstorm known as a supercell. A supercell is a long-lived, rotating thunderstorm 10 to 16 km (6 to 10 mi) in diameter that may last several hours, travel hundreds of miles, and produce several tornadoes.

Supercell tornadoes are often produced in sequence, so that what appears to be a very long damage path from one tornado may actually be the result of a new tornado that forms in the area where the previous tornado died. Sometimes, tornado outbreaks occur, and swarms of supercell storms may occur. Each supercell may spawn a tornado or a sequence of tornadoes. The complete process of tornado formation in supercells is still debated among meteorologists. Scientists generally agree that the first stage in tornado formation is an interaction between the storm updraft and the winds.

An updraft is a current of warm, moist air that rises upward through the thunderstorm. The updraft interacts with the winds, which must change with height in favorable ways for the interaction to occur. This interaction causes the updraft to rotate at the middle levels of the atmosphere. The rotating updraft, known as a mesocyclone, stabilizes the thunderstorm and gives it its long-lived supercell characteristics. The next stage is the development of a strong downdraft (a current of cooler air that moves in a downward direction) on the backside of the storm, known as a rear-flank downdraft.

It is not clear whether the rear-flank downdraft is induced by rainfall or by pressure forces set up in the storm, although it becomes progressively colder as the rain evaporates into it. This cold air moves downward because it is denser than warm air. The speed of the downdraft increases and the air plunges to the ground, where it fans out at speeds that can exceed 160 km/h (100 mph). The favored location for the development of a tornado is at the area between this rear-flank downdraft and the main storm updraft.

However, the details of why a tornado should form there are still not clear. The same condensation process that creates tornadoes makes visible the generally weaker sea-going tornadoes, called waterspouts. Waterspouts occur most frequently in tropical waters. OccurrenceThe United States has the highest average annual number of tornadoes in the world, about 800 per year. Outside the United States, Australia ranks second in tornado frequency. Tornadoes also occur in many other countries, including China, India, Russia, England, and Germany.

Bangladesh has been struck several times by devastating killer tornadoes. In the United States, tornadoes occur in all 50 states. However, the region with

the most tornadoes is “ Tornado Alley,” a swath of the Midwest extending from the Texas Gulf Coastal Plain northward through eastern South Dakota. Another area of high concentration is “ Dixie Alley,” which extends across the Gulf Coastal Plain from south Texas eastward to Florida. Tornadoes are most frequent in the Midwest, where conditions are most favorable for the development of the severe thunderstorms that produce tornadoes.

The Gulf of Mexico ensures a supply of moist, warm air that enables the storms to survive. Weather conditions that trigger severe thunderstorms are frequently in place here: convergence (flowing together) of air along boundaries between dry and moist air masses, convergence of air along the boundaries between warm and cold air masses, and low pressure systems in the upper atmosphere traveling eastward across the plains. In winter, tornado activity is usually confined to the Gulf Coastal Plain. In spring, the most active tornado season, tornadoes typically occur in central Tornado Alley and astward into the Ohio Valley. In summer, most tornadoes occur in a northern band stretching from the Dakotas eastward into Pennsylvania and southern New York State. The worst tornado disasters in the United States have claimed hundreds of lives. The Tri-State Outbreak of March 18, 1925, had the highest death toll: 740 people died in 7 tornadoes that struck Illinois, Missouri, and Indiana. The Super Outbreak of April 3-4, 1974, spawned 148 tornadoes (the most in any known outbreak) and killed 315 people from Alabama north to Ohio.

Floods When it rains or snows, some of the water is retained by the soil, some is absorbed by vegetation, some evaporates, and the remainder, which reaches stream channels, is called runoff. Floods occur when soil and

vegetation cannot absorb all the water; water then runs off the land in quantities that cannot be carried in stream channels or retained in natural ponds and constructed reservoirs. About 30 percent of all precipitation is runoff, and this amount may be increased by meltingsnowmasses.

Periodic floods occur naturally on many rivers, forming an area known as the flood plain. These river floods often result from heavy rain, sometimes combined with melting snow, which causes the rivers to overflow their banks; a flood that rises and falls rapidly with little or no advance warning is called a flash flood. Flash floods usually result from intense rainfall over a relatively small area. Coastal areas are occasionally flooded by unusually high tides induced by severe winds over ocean surfaces, or by tsunamis caused by undersea earthquakes.

Effects of Floods-Floods not only damage property and endanger the lives of humans and animals, but have other effects as well. Rapid runoff causes soil erosion as well as sediment deposition problems downstream. Spawning grounds for fish and other wildlife habitat are often destroyed. High-velocity currents increase flood damage; prolonged high floods delay traffic and interfere with drainage and economic use of lands. Bridge abutments, bank lines, sewer outfalls, and other structures within floodways are damaged, and navigation and hydroelectric power are often impaired.

Financial losses due to floods are commonly millions of dollars each year. Drought Drought, condition of abnormally dry weather within a geographic region where some rain might usually be expected. A drought is thus quite different from a dry climate, which designates a region that is normally, or at least seasonally, dry. The term drought is applied to a period in which an

unusual scarcity of rain causes a serious hydrological imbalance: Water-supply reservoirs empty, wells dry up, and crop damage ensues.

The severity of the drought is gauged by the degree of moisture deficiency, its duration, and the size of the area affected. If the drought is brief, it is known as a dry spell, or partial drought. A partial drought is usually defined as more than 14 days without appreciable precipitation, whereas a drought may last for years. Droughts tend to be more severe in some areas than in others. Catastrophic droughts generally occur at latitudes of about 15°-20°, in areas bordering the permanently arid regions of the world.

Permanent aridity is a characteristic of those areas where warm, tropical air masses, in descending to earth, become hotter and drier. When a poleward shift in the prevailing westerlies occurs , the high-pressure, anticyclonic conditions of the permanently arid regions impinge on areas that are normally subject to seasonally wet low-pressure weather and a drought ensues. A southward shift in the westerlies caused the most severe drought of the 20th century, the one that afflicted the African region called the Sahel for a dozen years, beginning in 1968.

In North America, archaeological studies of Native Americans and statistics derived from long-term agricultural records show that six or seven centuries ago whole areas of the Southwest were abandoned by the indigenous agriculturists because of repeated droughts and were never reoccupied. The statistics indicate that roughly every 22 years—with a precision of three to four years—a major drought occurs in the United States, most seriously affecting the Prairie and midwestern states.

The disastrous drought of the 1930s, during which large areas of the Great Plains became known as the Dust Bowl, is one example. The effect of the drought was aggravated by overcropping, overpopulation, and lack of timely relief measures. In Africa, the Sahel drought was also aggravated by nonclimatic determinants such as overcropping, as well as by problems between nations and peoples unfriendly with one another. Although drought cannot be reliably predicted, certain precautions can be taken in drought-risk areas.

These include construction of reservoirs to hold emergency water supplies, education to avoid overcropping and overgrazing, and programs to limit settlement in drought-prone areas. Volcano Volcano, mountain or hill formed by the accumulation of materials erupted through one or more openings (called volcanic vents) in the earth's surface. The term volcano can also refer to the vents themselves. Most volcanoes have steep sides, but some can be gently sloping mountains or even flat tablelands, plateaus, or plains.

The volcanoes above sea level are the best known, but the vast majority of the world's volcanoes lie beneath the sea, formed along the global oceanic ridge systems that crisscross the deep ocean floor . According to the Smithsonian Institution, 1, 511 above-sea volcanoes have been active during the past 10, 000 years, 539 of them erupting one or more times during written history. On average, 50 to 60 above-sea volcanoes worldwide are active in any given year; about half of these are continuations of eruptions from previous years, and the rest are new.

Volcano Formation-All volcanoes are formed by the accumulation of magma (molten rock that forms below the earth's surface). Magma can erupt

through one or more volcanic vents, which can be a single opening, a cluster of openings, or a long crack, called a fissure vent. It forms deep within the earth, generally within the upper part of the mantle (one of the layers of the earth’s crust), or less commonly, within the base of the earth's crust. High temperatures and pressures are needed to form magma.

The solid mantle or crustal rock must be melted under conditions typically reached at depths of 80 to 100 km (50 to 60 mi) below the earth’s surface. Once tiny droplets of magma are formed, they begin to rise because the magma is less dense than the solid rock surrounding it. The processes that cause the magma to rise are poorly understood, but it generally moves upward toward lower pressure regions, squeezing into spaces between minerals within the solid rock. As the individual magma droplets rise, they join to form ever-larger blobs and move toward the surface.

The larger the rising blob of magma, the easier it moves. Rising magma does not reach the surface in a steady manner but tends to accumulate in one or more underground storage regions, called magma reservoirs, before it erupts onto the surface. With each eruption, whether explosive or nonexplosive, the material erupted adds another layer to the growing volcano. After many eruptions, the volcanic materials pile up around the vent or vents. These piles form a topographic feature, such as a hill, mountain, plateau, or crater, that we recognize as a volcano.

Most of the earth's volcanoes are formed beneath the oceans, and their locations have been documented in recent decades by mapping of the ocean floor. Volcanic Materials- 1-Lava-Lava is magma that breaks the surface and erupts from a volcano. If the magma is very fluid, it flows rapidly down the

volcano’s slopes. Lava that is more sticky and less fluid moves slower. Lava flows that have a continuous, smooth, ropy, or billowy surface are called pahoehoe (pronounced pah HOH ee hoh ee) flows, while aa (pronounced ah ah) flows have a jagged surface composed of loose, irregularly shaped lava chunks.

Once cooled, pahoehoe forms smooth rocks, while aa forms jagged rocks. The words pahoehoe and aa are Hawaiian terms that describe the texture of the lava. Lava may also be described in terms of its composition and the type of rock it forms. Basalt, andesite, , and rhyolite are all different kinds of rock that form from lava. Each type of rock, and the lava from which it forms, contains a different amount of the compound silicon dioxide. Basaltic lava has the least amount of silicon dioxide, andesitic and dacitic lava have medium levels of silicon dioxide, while rhyolitic lava has the most. -Tephra- Tephra, or pyroclastic material, is made of rock fragments formed by explosive shattering of sticky magma (see Pyroclastic Flow). The term pyroclastic is of Greek origin and means 'fire-broken' (pyro, “ fire”; klastos, “ broken”). Tephra refers to any airborne pyroclastic material regardless of size or shape. The best-known tephra materials include pumice, cinders, and volcanic ash. These fragments are exploded when gases build up inside a volcano and produce an explosion. The pieces of magma are shot into the air during the explosion.

Ash refers to fragments smaller than 2 mm (0. 08 in) in diameter. The finest ash is called volcanic dust and is made up of particles that are less than 0. 06 mm (0. 002 in) in diameter. Volcanic blocks, or bombs, are the largest fragments of tephra, more than 64 mm (2. 5 in) in diameter (baseball size or

larger). Some bombs can be the size of a small car. 3-Gases-Gases, primarily in the form of steam, are released from volcanoes during eruptions. All eruptions, explosive or nonexplosive, are accompanied by the release of volcanic gas.

The sudden escape of high-pressure volcanic gas from magma is the driving force for eruptions. Gases come from the magma itself or from the hot magma coming into contact with water in the ground. Volcanic plumes can appear dark during an eruption because the gases are mixed with dark-colored materials such as tephra. Most volcanic gases predominantly consist of water vapor (steam), with carbon dioxide (CO_2) and sulfur dioxide (SO_2) being the next two most common compounds along with smaller amounts of chlorine and fluorine gases.

Types of Volcano 1-Cinder Cones and Composite Volcanoes-Cinder cones and composite volcanoes have the familiar conelike shape that people most often associate with volcanoes. Some of these form beautifully symmetrical volcanic hills or mountains such as Paricutin Volcano in Mexico and Mount Fuji in Japan. Although both cinder cones and composite volcanoes are mostly the results of explosive eruptions, cinder cones consist exclusively of fragmental lava. This fragmental lava is erupted explosively and made up of cinders. -Shield Volcanoes-Shield volcanoes (also called volcanic shields) get their name from their distinctive, gently sloping mound-like shapes that resemble the fighting shields that ancient warriors carried into battle.

Their shapes reflect the fact that they are constructed mainly of countless fluid basaltic lava flows that erupted nonexplosively. Such flows can easily spread great distances from the feeding volcanic vents, similar to the

spreading out of hot syrup poured onto a plate. Volcanic shields may be either small or large, and the largest shield volcanoes are many times larger than the largest composite volcanoes. -Caldera-A caldera is a round or oval-shaped low-lying area that forms when the ground collapses because of explosive eruptions. An explosive eruption can explode the top off of the mountain or eject all of the magma that is inside the volcano. Either of these actions may cause the volcano to collapse. Calderas can be bigger than the largest shield volcanoes in diameter. Such volcanic features, if geologically young, are often outlined by an irregular, steep-walled boundary (a caldera rim), which reflects the original ringlike zone, or fault, along which the ground collapse occurred.

Some calderas have hills and mountains rising within them, called resurgent domes, that reflect volcanic activity after the initial collapse. 4-Volcanic Plateaus-Some of the largest volcanic features on earth do not actually look like volcanoes. Instead, they form extensive, nearly flat-topped accumulations of erupted materials. These materials form volcanic plateaus or plains covering many thousands of square kilometers. The volcanic materials can be either very fluid basaltic lava flows or far-traveled pyroclastic flows.

The basaltic lava flows are called flood or plateau basalts and are erupted from many fissure vents. Volcano Hazards-Eruptions pose direct and indirect volcano hazards to people and property, both on the ground and in the air. Direct hazards are pyroclastic flows, lava flows, falling ash, and debris flows. Pyroclastic flows are mixtures of hot ash, rock fragments, and gas. They are

especially deadly because of their high temperatures of 850° C (1600° F) or higher and fast speeds of 250 km/h (160 mph) or greater.

Lava flows, which move much more slowly than pyroclastic flows, are rarely life threatening but can produce massive property damage and economic loss. Heavy accumulations of volcanic ash, especially if they become wet from rainfall, can collapse roofs and damage crops. Debris flows called lahars are composed of wet concretelike mixtures of volcanic debris and water from melted snow or ice or heavy rainfall. Lahars can travel quickly through valleys, destroying everything in their paths. Pyroclastic and volcanic debris flows have caused the most eruption-related deaths in the 20th century.