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Commentary

Earthquakes: Understanding Nature's Sudden Shakes

Ema Abraham*

Department of Geology/Geophysics, Alex Ekwueme Federal University, Ndufu-Alike Ikwo, Ebonyi, Nigeria

DESCRIPTION

Earthquakes are among the most powerful and unpredictable natural events on Earth. In just seconds, they can reshape landscapes, destroy buildings, and change the lives of millions. Despite advances in science and technology, earthquakes continue to strike without warning, reminding us of the incredible forces operating beneath our feet.

What is an earthquake

An earthquake is the sudden shaking of the Earth's surface caused by the release of energy stored in the Earth's crust. This release of energy occurs when rocks underground suddenly break along a fault, creating seismic waves that travel through the Earth. The point on the surface directly above where the fault slips is known as the epicenter, and the point within the Earth where it begins is called the focus or hypocenter.

Seismic waves are responsible for the trembling we feel during an earthquake. These waves come in different forms, including Primary waves (P-waves), Secondary waves (S-waves), and Surface waves, each with different speeds and effects.

Causes of earthquakes

The Earth's crust is divided into large pieces called tectonic plates, which float atop the semi-fluid layer of the mantle. These plates are constantly moving, albeit very slowly. Most earthquakes are caused by the interaction of these plates. The main causes include:

Tectonic plate movement: Most earthquakes happen at plate boundaries—zones where plates collide, pull apart, or slide past each other. These interactions build up stress that eventually gets released as an earthquake.

Volcanic activity: Earthquakes often occur in volcanic regions due to magma movement beneath the surface.

Human activity: Activities like mining, reservoir-induced seismicity (due to dams), and fracking can also cause small to moderate earthquakes.

Measuring earthquakes

Earthquakes are measured in two main ways:

Magnitude: This refers to the amount of energy released and is commonly measured using the Richter scale or Moment Magnitude Scale (Mw). Each increase of one unit represents ten times more shaking and about 32 times more energy release.

Intensity: This describes the effects on people, structures, and the Earth's surface and is measured using the Modified Mercalli Intensity Scale (MMI).

For example, a magnitude 4.0 quake might be felt like a brief shake, while a magnitude 7.0 or higher can cause widespread damage.

Effects of earthquakes

Earthquakes can have devastating consequences, especially in densely populated areas. Some of the main effects include:

Ground shaking: This can damage buildings, bridges, and roads, especially if structures are not earthquake-resistant.

Surface rupture: Fault lines may break through to the surface, damaging anything in their path.

Soil liquefaction: Saturated soil can behave like a liquid during strong shaking, leading to the collapse of buildings.

Landslides: Steep or unstable slopes may fail during or after an earthquake.

Tsunamis: Undersea earthquakes can displace large volumes of water, creating massive sea waves that impact coastlines.

Notable earthquakes in history

Some earthquakes have left a lasting mark on human history due to their destruction and loss of life:

2004 Indian Ocean Earthquake (Magnitude 9.1): Triggered a tsunami that killed over 230,000 people in 14 countries.

Correspondence to: Ema Abraham, Department of Geology/Geophysics, Alex Ekwueme Federal University, Ndufu-Alike Ikwo, Ebonyi, Nigeria, E-mail: ema.abrahm@funai.edu

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2010 Haiti Earthquake (Magnitude 7.0): Caused massive devastation in Port-au-Prince, killing more than 160,000.

2011 Tōhoku Earthquake in Japan (Magnitude 9.0): Led to a major tsunami and nuclear disaster at Fukushima.

Earthquake preparedness

Since earthquakes can't be predicted, preparedness is crucial to reducing damage and saving lives. Here are some key steps:

Building Codes: Construct buildings and infrastructure to withstand seismic forces.

Emergency kits: Every household should have food, water, flashlights, and first-aid supplies ready.

Education and drills: Schools and offices should conduct earthquake drills to teach people how to react.

Drop, cover, and hold on: This is the recommended action during shaking—drop to the ground, take cover under sturdy furniture, and hold on until the shaking stops.

The role of science and technology

Seismology, the scientific study of earthquakes, has made great progress in recent decades. Networks of seismometers around the world detect and analyze seismic activity in real time. While scientists still can't predict earthquakes with certainty, they can assess earthquake risks in different regions and develop early warning systems that give people a few crucial seconds to take cover or halt sensitive operations.

Countries like Japan and Mexico have developed early warning systems that can alert citizens seconds before the shaking starts, using data from nearby seismic sensors.

CONCLUSION

Earthquakes are reminders of Earth's dynamic and ever-changing nature. While they can bring destruction, they also drive the natural processes that shape continents and create mountains. With better understanding, responsible construction, and community awareness, we can live more safely in earthquake-prone regions. As our knowledge and technology improve, so too does our ability to face the trembling ground beneath us with preparedness and resilience.