Interview: The science behind earthquakes

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Professor Cole studies the science behind earthquakes and other natural disasters. Photo by Lauren McFalls.

(PhysOrg.com) -- A series of major earthquakes have struck countries in the Caribbean, South America and Asia, causing catastrophic damage. Large-scale relief efforts are in place in the hardest-hit nations, including Haiti and Chile. Northeastern earth and environmental sciences professor Jennifer Cole discusses what causes earthquakes and how one natural disaster can lead to another.

Q: The recent earthquakes in Haiti, China, Japan and Chile have drawn the public's attention to the age-old topic of natural disasters. To begin with, what causes an earthquake*?*

Earthquakes result from the movement of tectonic plates. As tectonic plates slide past each other — the stick-slip phenomenon — energy builds up in the rocks until they can no longer hold the stress. This causes failure in the form of breaking rocks, sending energy waves outward. The earthquakes in Haiti, China, Japan, and Chile all happened because of this series of events.

Glaciers may also cause earthquakes. During the last glacial period, the ice sheet was up to 2.5 miles thick. This pushed down on the Earth's crust, causing a depression. When the weight was lifted due to glacial melting, the depressed crust began to stick-slip on its way back to the pre-depressed elevation.
In addition, humans can cause earthquakes by damming rivers, creating a reservoir heavy enough to cause a depression in the earth's crust.

Were these earthquakes related?

These earthquakes all occurred as a result of the movement of different plates but the real truth is, no one can say with certainty. My thought is that we just happened to have a few big earthquakes in a short period of time in highly populated areas, causing a lot of destruction.

How often do earthquakes happen? Are they predictable?

Earthquakes happen all of the time. For example, we have an earthquake in Boston about once every other day, but they are so small that we can't feel them. When we look at the predictability of natural disasters, earthquakes remain the most unpredictable.

The earthquake in Chile was the largest in the series of recent earthquakes, measuring 8.8 in magnitude. Is Chile more prone to powerful earthquakes?

Chile is a hot spot for major earthquakes due to its location. The

earthquake in Chile was so massive that it shifted Earth's axis by three inches and shortened days on Earth by 1.26 milliseconds. In addition, the largest earthquake ever recorded, a 9.5 on the moment magnitude scale (successor to the Richter magnitude scale), occurred in Chile in 1960.

A massive earthquake is usually followed by a sequence of aftershocks, landslides and tsunamis. How does one disaster trigger the others?

Many natural disasters are related. For example, following a hurricane, there may be landslides due to mountainsides becoming overly saturated with water, and becoming too heavy to maintain their original position. The flash flooding on the Portuguese island of Madeira earlier this year similarly triggered landslides.

Earthquakes are capable of causing tsunamis. In the unique case when an earthquake occurs on the ocean floor, a rock is forced up, causing a disturbance in the water column that extends to the ocean surface. Waves then travel outward in a series of concentric circles at a rapid rate, up to 550 miles per hour, or as fast as a jet airplane travels. When tsunamis reach shallow water, they slow down and grow taller, forming massive waves. These waves travel inland and cause flooding and increase the potential of coastal landslides.

Could climate change cause more earthquakes?

Some scientists are making the case that global warming is contributing to an increase in earthquake activity by making the ocean water warmer, and therefore, heavier. Additionally, melting glaciers take weight off of tectonic plates, which can cause them to pop upwards in those areas, resulting in earthquakes. Volcanoes are also thought to become active as a result of the decreased [glacial] load in places such as Iceland.

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