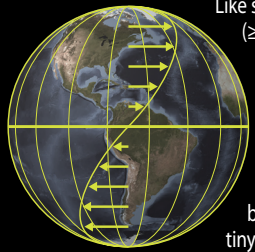
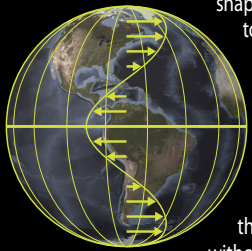
Did you know that after a large earthquake, the Earth "rings" like a gong?





Like striking a gong, very large earthquakes (≥ M6.5) release enough energy to cause the surface of the entire Earth to detectably vibrate! In the case of the M9.3 Sumatra earthquake on December 26, 2004, the vibrations were recorded by the Global Seismographic Network for over 5 months! Termed *free oscillations* by seismologists, these vibrations cause tiny three-dimensional distortions in the shape and volume of the Earth, and are used to provide key information on the planet's interior and the earthquakes that excited them. The distortions are of two types, or modes: *spheroidal* and *torsional*.

Torsional modes (see left) involve only sideways, or shear, displacements parallel to the Earth's surface, so that the Earth's surface twists back and forth without altering the planet's volume. This type of shearing motion is restricted to the crust and mantle because shearing motions cannot be transmitted through the liquid outer core. The longest period observed to date for a torsional mode is about 44 min.

Spheroidal modes, two of which are depicted on the front of this card (*exaggerated 10 billion times!), involve displacements inward and outward from the center of the Earth such that the Earth's surface height and volume are altered. The "breathing" mode involves the Earth expanding, contracting, and expanding again in a period of about 20.5 min. The "football" mode involves the Earth alternating between a football and disk shape and back in a period of about 54 min, and is the longest period spheroidal mode.

Why Don't We Feel Free Oscillations?

Humans are unable to detect the free oscillations of the Earth because the motions are very small. For example, in the 2004 Sumatra earthquake the Earth's surface moved in and out by approximately 0.1 millimeter as a result of the "breathing mode" vibrations.

View animations and learn more about Earth's free oscillations and modes at www.iris.edu/eno/earthmodes

"The Pulse of the Earth"

Earth's free oscillations after earthquakes

"Breathing" mode
period = 20.5 min.

*exaggerated 10 billion times!

"Football" mode
period = 54 min.

incorporated research institutions for seismology

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