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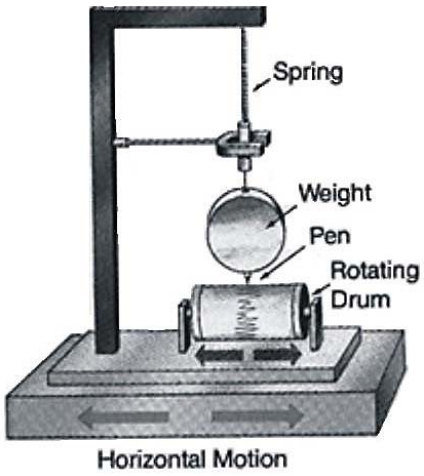
U.S. Contribution to the Indian Ocean Tsunami Warning System

FACT SHEET

How Do Seismometers Contribute to a Tsunami Warning System?



An early model of a seismometer, or seismograph.

Seismoscope, invented in 132 A.D (China).

The US IOTWS Program is supporting upgrades of detection devices that contribute critical data to the determination of warning for tsunami events. One important component of a tsunami warning system is the need for accurate data on the magnitude and location of earthquakes that might trigger a tsunami. In this regard, the U.S. Geologic Survey (USGS), through the US IOTWS Program, is supporting seismometer upgrades in the Indian Ocean region.

How Seismometers Work

A **seismometer**, or **seismograph**, is a device that geologists use to measure and record seismic waves. By studying these recordings, scientists can map the earth's interior, and they can measure or locate earthquakes and other ground motions. These earthquakes can generate tsunamis in the ocean which eventually impact land. By analyzing the earthquakes, scientists can determine the likelihood that a tsunami will form, and they can issue warnings if warranted.

A basic seismometer is comprised of a frame (securely affixed to the earth), a spring, a weight, a pen, and a rotating drum, much like the figure to the left. As an earthquake occurs, the frame moves with the earth, and moves around the weight. As the frame moves, the rotating drum also moves, and the pen makes marks on the drum. These marks measure the relative motion between the frame and the weight.

Early seismometers recorded these markings as scratches on smoked glass, or as exposures of light beams on photographic paper. Modern, digital seismometers use electronics, and can record both vertical and horizontal motion. The weight in newer seismometers is held by an electronegative feedback loop that drives a coil, and the results are often fed directly to a computer

Types of Seismometers

Strong Motion Sensor. Designed to measure large amplitude (0.001-2g) and high frequency waves (1-100Hz) which are typical of large local earthquakes.

Broadband Seismometer. Detects motion over a wide range of frequencies (0.01-50Hz) and usually over a large range of amplitudes (0.05-20Hz). Most useful for recording regional earthquakes and teleseismic events.

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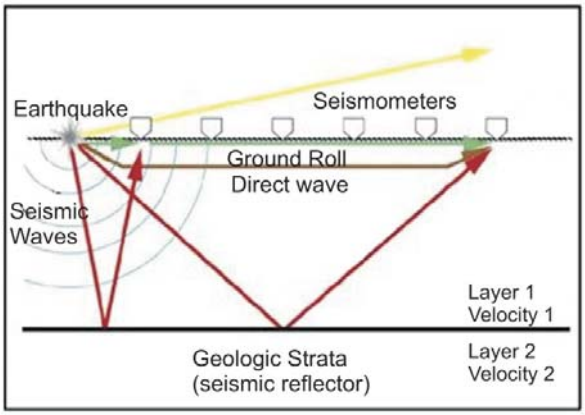


Seismometers can measure the seismic waves as they bounce, or reflect, off the geologic strata, or the waves can be measured directly by the seismometer.

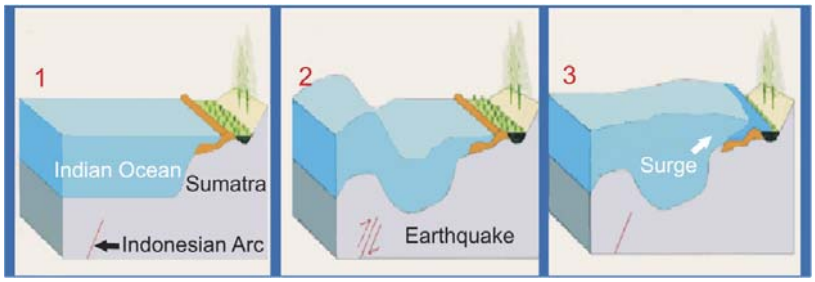
Short Period Seismometer. Mainly used to measure signals above 1Hz (cycles/second). This type of seismometer is most often used to measure local earthquakes as well as P-waves (Primary waves) from teleseisms (a seismic movement or shock far from the recording instrument).

How Are Earthquakes Measured?

Earthquakes are measured on what is called the Richter Scale. The Richter scale is a base-10 logarithmic scale, and was created by Charles Richter, along with Beno Gutenberg in 1935. The Richter scale determines an earthquake's magnitude or intensity. This is one of the factors used in deciding if a tsunami is likely to have been generated.

How Will the Seismometers Be Used to Detect Tsunamis?

Between 2005 and 2007, USAID and the USGS will actively be involved in enhancing and upgrading the seismic recording capabilities of the Indian Ocean region. The USGS's National Earthquake Information Center (NEIC) will work with the Regional or National Centers to demonstrate how to build and maintain a network of seismometers that can record potential tsunamigenic events. Having an expanded network of seismic instruments is just the first step toward accurate predictions of tsunamis. Hardware and software used to analyze the seismic data in real-time must also be improved. When finished, this will increase the recording capacity and processing rate of seismic data in order to improve the speed and accuracy of determining earthquake locations, magnitudes, and other parameters relevant to declaring a tsunami warning. In order to build local and regional capacity, technical improvements in software, hardware, and communications will be shared with and among the five regional countries through training workshops, and through USGS-sponsored visits by seismologists in the region to NEIC for hands-on experience.



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About the US Indian Ocean Tsunami Warning System (IOTWS) Program

The US IOTWS Program is part of the international effort to develop tsunami warning system capabilities in the Indian Ocean following the December 2004 tsunami disaster. The US program adopts an "end-to-end" approach—addressing regional, national, and local aspects of a truly functional warning system—along with multiple other hazards that threaten communities in the region. In partnership with the international community, national governments, and other partners, the US program offers technology transfer, training, and information resources to strengthen the tsunami warning and preparedness capabilities of national and local stakeholders in the region. For more information please visit **www.us-iotws.gov**.

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