

Monitoring and predicting earthquakes and volcanoes - 2013 Q3C

Earthquakes can be very hard to predict as they occur randomly below the Earth's surface from a build up of pressure between two converging plates, or sometimes due to friction or a sudden shift during the movement of plates at a passive plate boundary.

Although animal behaviour is not a scientifically proven method, some people believe animal behaviour can indicate an oncoming earthquake. These behaviours include: rats fleeing towns, animals coming out of hibernation early and farm animals refusing to enter their shelters. It is believed that it is unlikely that these animals are predicting an earthquake but more so reacting to primary (P) waves that are undetectable by humans. However, animal behaviour can give humans a precious few seconds warning before an earthquake hits.

Another method of prediction is through the examination of historical records. Historical records can help create a rough idea of when an earthquake might occur. This method helps to create a long term forecast and can help to identify a pattern of frequency for earthquake activity in an area. However, this method is also unreliable because each plate movement changes the characteristics of the fault line, making many previous timelines irrelevant.

The most reliable and accurate method of predicting earthquakes is through the measurement of rock stress along fault lines. Seismologists (people who study earthquakes) use a number of instruments to monitor pressure build-up at fault lines. As the pressure increases, so does the likelihood of an earthquake. Strainmeters are placed at fault lines to record pressure levels, predicting when the pressure will be too much and an earthquake will occur e.g. prediction of the 'Big One' along the East coast of America, in particular the California coast. Satellites and GPS monitor any ground deformation that may indicate an oncoming earthquake. Seismographs detect vibrations in the Earth's crust. These foreshocks occur prior to an earthquake. Tiltmeters are used to detect a change in the slope of the land. Bulging on the surface can indicate significant pressure in the rock and ground below.

Seismometers, satellite/GPS and tiltmeters are also used to detect volcanic activity. Earthquakes generally occur prior to a volcanic eruption and are caused by magma and volcanic gas forcing their way upward through cracks and vents in the Earth's crust. This force causes rock to vibrate and trigger earthquakes. Tiltmeters, EDMs and GPS are all used to monitor ground deformation which is the most obvious sign of an oncoming volcanic eruption. EDMs (Electronic Distance Measurement) use a laser and receiver to track the size of a volcano. A tiltmeter detects any change in slope level in a similar way a spirit level would. Any change in the slope of a volcanic mountain signifies an increase in the pressure inside the volcano. This method was used to predict and monitor the eruption of Mt. St. Helens in Washington in 1980.