GPS Geodesy

Overview of Geodesy

Geodesy is the science that deals with the size and shape of the Earth. To track current plate movement, geodesy can be measured with ground-based or space-based techniques.


Ground-surveying techniques are conventional but precise for taking ground-based measurements.


Since plate motion is global in scale, satellites are used to take measurements from space for the best accuracy.

Overview of Global Satellite Positioning (GPS)

Global Positioning System (GPS) is a space-based technique for studying geodesy. GPS has been the most useful for assessing crustal movements of the Earth. By taking precise, repeated measurements, geologists can assess active movement along faults or between plates.
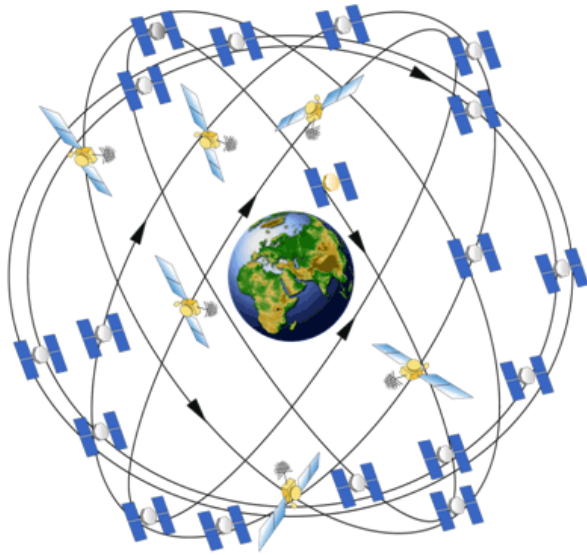

Currently, 24 satellites are in orbit 20,000 km above the Earth as part of the NavStar system of the U.S. Department of Defense. These satellites continuously transmit radio signals back to Earth which are interpreted by ground receivers.
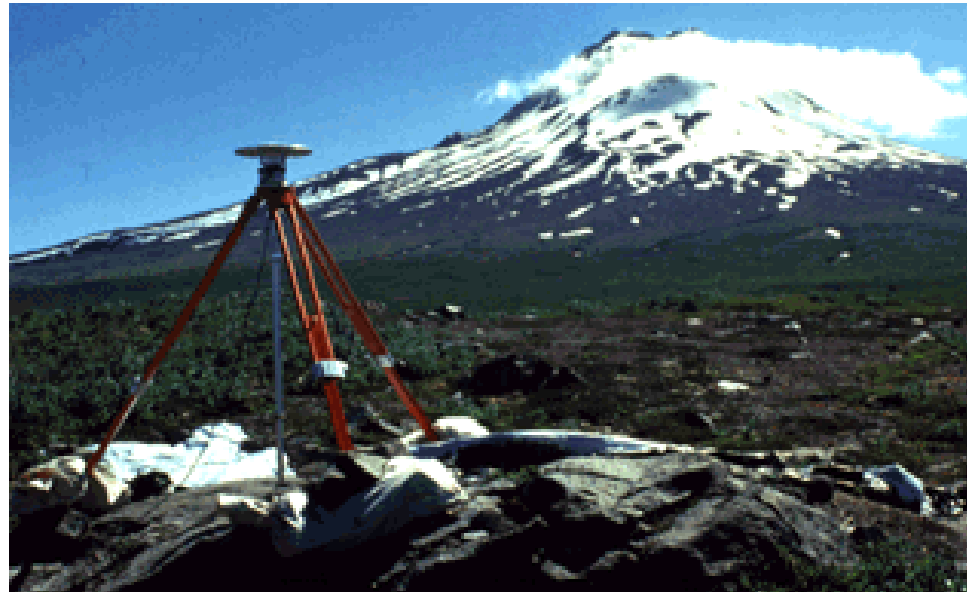
GPS ground receivers are located at carefully chosen points on the Earth's surface and separated by hundreds to thousands of kilometers. These receivers can determine their precise position on Earth including longitude, latitude, and elevation. To record position, the receiver must simultaneously receive signals from at least four satellites. Changes in position record tectonic motions of the plates.

Geodesy and the Pacific Ring of Fire

Geologists compare receiver measurements to interpret crustal movement. For example, the separations between GPS sites around the Pacific Basin are measured regularly to understand geologic events in the Pacific Ring of Fire.
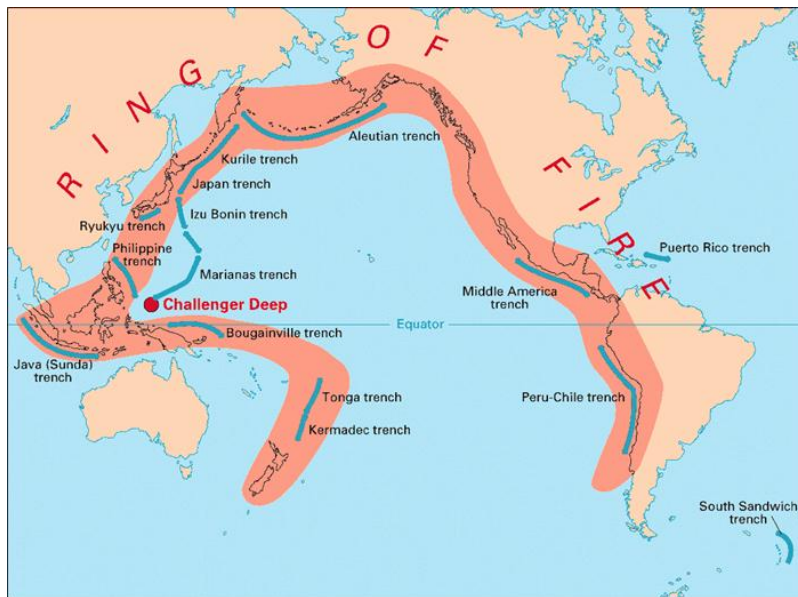
By monitoring the interaction between the Pacific Plate and the surrounding, largely continental plates, scientists hope to learn more about the events building up to earthquakes and volcanic eruptions in the Pacific Ring of Fire.

In this map, each of the green circles represents the current position of a receiver. The yellow line indicates how that receiver has moved over time. Longer lines represent more movement.