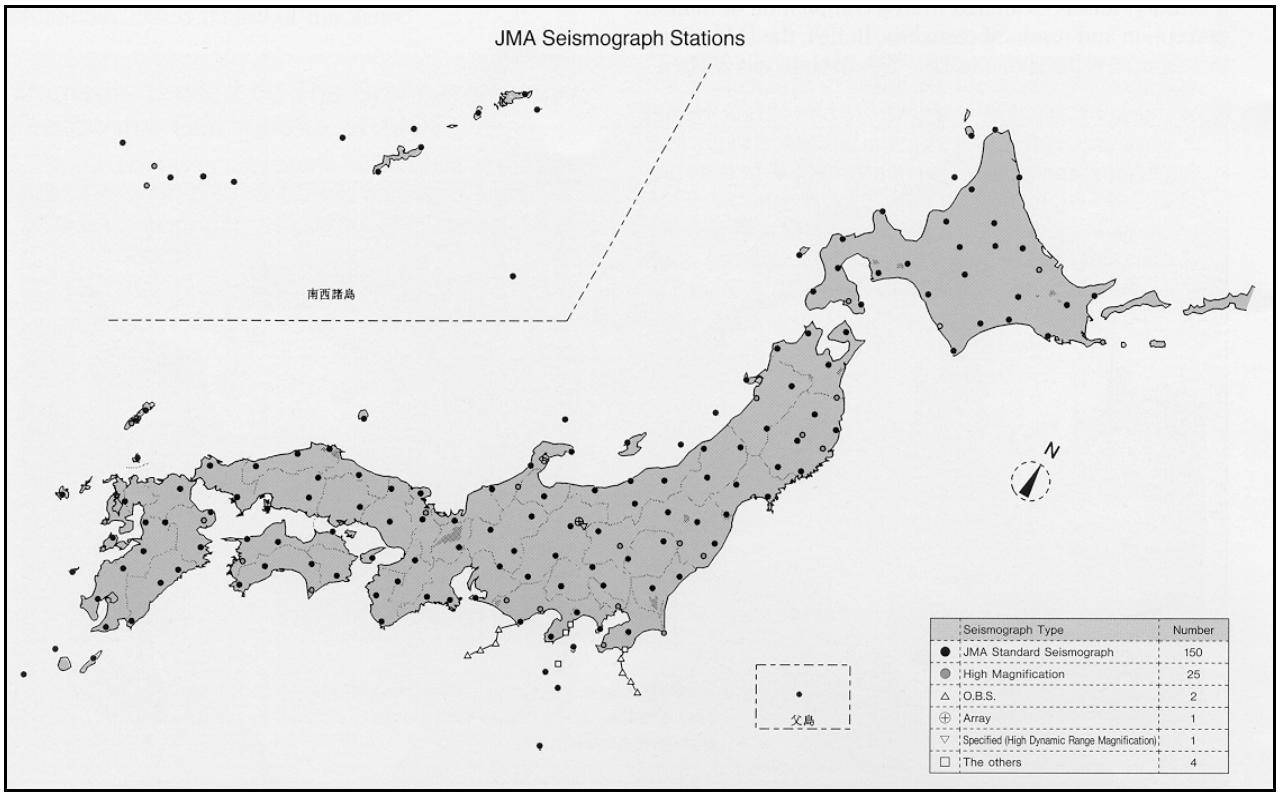
Data

Warning centers use real or near-real time seismic and water level data as well as historical tsunami and earthquake data to rapidly detect and locate potentially tsunamigenic earthquakes, to confirm that a tsunami was generated, and to estimate its potential impact to coastlines in its area of responsibility.

Seismic Data

Seismic signals, the vibrations from earthquakes that propagate rapidly through the earth, are used by warning centers to detect the occurrence of an earthquake, and then to determine its location and size. Based on this information, the likelihood that a tsunami may have been generated can be estimated quickly, and appropriate initial warnings or informational messages issued. Standard short-period (0.5-2 sec/cycle) and long-period (18-22 sec/cycle) seismometers provide data to locate and size the earthquake. Data from newer broadband (0.01-100 sec/cycle) seismometers can be used for both of the above purposes and also for computing seismic moment, a better measure of size for the largest and most potentially tsunamigenic earthquakes. Seismic data is sent to the centers in real or near real time in the form of continuous waveforms, triggered waveforms, or parametric data (for example, P wave arrival times) using a variety of short and long range communications techniques. In certain cases, seismic data is completely processed by another observatory, and only earthquake location and magnitude are sent.

To determine the location of an earthquake requires data from many seismic sensors, ideally located in a pattern that surrounds the event. For nearby earthquakes a dense array of seismic stations is often used to get a quick and accurate location. Less precise, but adequate locations may also be obtained from a single three-component seismic station if techniques of particle motion analysis are used, as they are in the TREMORS (Tsunami Risk Evaluation through seismic MOment from a Real-time System) algorithm. TREMORS also has the ability to automatically estimate seismic moment from broadband data every 50 seconds after the onset of the P wave, making it an ideal analysis tool for local, regional, and ocean-wide tsunami warning systems.



The tsunami warning system in Japan relies on the Japan Meteorological Agency's Seismic Observation Network, an array of about 180 seismic stations distributed more or less uniformly throughout the country.