

Countermeasures against various types of tsunami earthquakes

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Tsunami earthquakes are those which generate tsunami greater than that expected from its magnitude determined from seismic amplitude. It is considered that there are two types of tsunami earthquake. One is a slow earthquake, in which radiation of short period seismic wave is relatively small. In those earthquake, the slip is usually small compared with its fault size. It is considered that tsunami generation is not different very much from that expected from the moment magnitude in those slow earthquakes. On the other hand, the amplitude of seismic wave is smaller than those of regular earthquakes of the same moment magnitude. Since conventional magnitudes based on seismic wave amplitude are often used for the first tsunami warning to be issued within three minutes after occurrence of the earthquake, the first tsunami warning may underestimate the tsunami height for slow earthquakes. Not to underestimate the tsunami height even for slow earthquakes, magnitude determination with more longer seismic wave or integrated displacement such as Mwp would be effective. Mwp is determined from teleseismic data. Other methods should be developed to determine appropriate magnitude from local seismic data of slow earthquakes.

On the other hand, there is another type of tsunami source such as submarine land slide or collapse of volcanoes. In 1792, Mt Mayuyama collapsed, and its volcanic debris avalanche caused high tsunami. Prediction of the collapse would be very difficult. However, it is possible to estimate the tsunami height and affected areas before the event by introducing some assumptions. In 1998, very high tsunami estimated to be caused by a submarine landslide attacked the shore of Papua New Guinea. We investigated the possibility of landslide detection by seismic waves, and got negative conclusions. Offshore tsunami gauges are considered to be effective countermeasure for such submarine landslides. Tsunami radar and microbarogram may be effective to detect offshore tsunami in addition to the GPS wave gauge and the submarine tsunami gauge.

Keywords: tsunami earthquake, slow earthquake, submarine landslide, volcanic debris avalanche