

The 2010 Chile earthquake and tsunami observed by nationwide strain and tilt observation network in Japan

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Universities and several institutions in Japan started the real-time strain and tilt data exchange experiment in 2009. Data are broadcasted under WIN protocol and gathered by database server operated at Hokkaido University. Total 87 stations data is distributed on data exchange system. To maximize broadband properties of strain-meter from several tens Hz to DC, data sampling interval is set to 100Hz to 1Hz.

The 2010 Chile earthquake is the first experience of large earthquake for our system. Strain, tilt and water level sensors in all over Japan well recorded the seismic waves. No deconvolution is needed to see the waveforms because of linear response of strain-meter to DC component. We can identify PKP, SS, LG and LR phases from raw-waveform data but no precursor signals as the 1960 great Chile earthquake. Clear SS pulse with 150 seconds duration was very similar with moment rate function estimated by USGS. This suggested the possibility of real-time seismic moment estimation from duration and shape of the pulses and its application to tsunami early warning system. Clear multi-orbit surface waves corresponding to circumnavigated the Earth for more than 7 times were observed.

Long-period strain and tilt changes were observed along the coast of Pacific ocean about one day after the arrival of seismic waves. Onset time of above changes corresponded with the arrival time of tsunami from Chile. These facts indicate the strain and tilt meters act as tsunami sensor. Elastic responses of crust by tsunami mass loading may reflect tsunami average height near the station. Nationwide strain and tilt observation network well observed seismic waves and tsunami with high accuracy broadband window. This experiment strongly suggests the high potential of strain and tilt sensors. Array analysis of crustal deformation data by real-time data exchange system will open new window for earth dynamics researches. We strongly propose its application for real-time seismic moment estimation and tsunami early warning system for near-field great earthquakes which will occur near future along Nankai trough.

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