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Seismic recordings of the Landslides caused by Typhoon Talas

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Typhoon Talas passed Japan Island on September 3-4, 2011 and brought substantial rainfall in western part of Japan. Total rainfall by this typhoon exceeds 2000mm in Kii peninsula, which caused many landslides in Nara, Wakayama, and Mie prefectures. 73 people were killed and 19 were reported missing by this typhoon.

The seismic signals due to these landslides are recorded by dense seismic network in Japan. The long-period surface waves are recorded by broadband seismic network (F-net) all over Japan (NIED, 2011), and short-period ground motions are recorded by the high-sensitive seismic network (Hi-net) as much as a few hundred km away. The landslide signals are usually tens of seconds long and have smooth onset, thus it is easy to distinguish to records of small earthquakes with couple of seconds duration. The typical landslide recordings are shown in Fig. 1, We applied back-projection technique (Spudich and Cranswick, 1984) to the records and determined the timing and location of each landslide signal.

We successfully detected several landslides in the continuous seismic recordings, and large events with volume more than 1 million m3 were located by the back-projection method. The seismic waveforms are very characteristic, and composed of high-frequency ground motion (frequency > 1Hz) and low-frequency ground motion (frequency < 0.1Hz). This complicated waveforms reflects the actual mechanism of landslides, and helps to understand the mass movement in time series.

The sequence of the landslides caused by Typhoon Talas can be located by the conventional source relocation technique in seismology. The seismic signal can tell the snapshot of the process of the landslides, which is rarely observed in visual (Suwa et al, Socio et al.). This is one of the most well-recorded landslide sequences all over the world. This seismic network is originally designed for locating seismic activities, but continuous records are very important to understand the mechanisms of the natural phenomenon as shown in this presentation.