

Features of T-phase recorded at Syowa Station in Antarctica

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Tectonic earthquakes and tremors related to ice (ice tremor) have been observed by seismic stations in Antarctica. In 2014, four type (type A –D) tremors characterized by their frequency components and waveforms were recorded around Syowa Station. Type A is the tremor of which duration is long (about ten thousands seconds) and the amplitude is small over the waveform. Type B shows that the dominant frequency changes irregularly over the waveform. Type C shows that the dominant frequency continuously decreases and the overtone is recognized. Type D has the waveform with spindle-shape and short duration (about hundreds seconds). Especially, the tremors of type D are similar to T-phase of tectonic earthquakes. The purpose of this study is to reveal the relationship between the type D tremors and earthquakes.

We use the waveform data recorded by STS-1 at Syowa Station. The analysis period is from January to December in 2014. We define here the tremor as tremors of which P-waves and S-waves are not clear and the duration is longer than five minutes. We count the ice tremors by visual inspection of seismograms and spectrograms calculated from FFT of velocity waveforms.

We find the total of nine tremors of type D in 2014, four from February to May, one in October and four in November and December, respectively. The features of type D recorded at Syowa station are the spindle-shape waveform, the dominant frequency of 1 –8 Hz and the duration ~400 s. We recognize that tectonic earthquakes occurred 10 - 20 minutes before the arrival of the four of type D. Each tectonic earthquake occurred on March 14 in South of Africa region (53.2S25.2E, Mb=5.5), on April 15 in Bouvet Island region (53.5S8.7E, Mb=6.8), on October 15 in South of Africa region (52.2S25.2E, Mb=5.5) and on November 17 in Prince Edward Islands region (46.3S33.8E, Mb=6.1), respectively. We calculate the residual of the travel times of each P-wave and T-phase as the seismic velocity are 6.5 km/s (P-wave) and 1.5 km/s (T-phase) and the average residual is 20 minutes 15 seconds. This theoretical residual corresponds to the observed value. The features of the remaining five tremors are similar to T-phase, but tectonic earthquakes are not recorded prior to the arrival of them. We suggest that these five tremors are not T-phase of earthquakes but ice tremors or relate to the earthquakes that radiate low P-wave and S-wave and high T-phase.

Keywords: Syowa Station, T-phase, ice tremor