

SCG058-P12

Room:Convention Hall

Time:May 23 10:30-13:00

Very low frequency tremors beneath Shonai plain revealed by Hi-net tiltmeters

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Monitoring of wave field in the frequency band from 0.05 to 0.2 Hz exhibits activities of very low frequency earthquakes (e.g. Ito et al., 2007) and those of volcanic tremors at Aso volcano (e.g. Kaneshima et al. 1996). In this study we showed new observation of very low frequency tremors beneath Shonai plain.

We analyzed records of Hi-net tiltmeters at about 700 stations from 2004/6 to 2006/6. At first we divided the stations into 6 sub-arrays, and we calculated wavenumber-frequency spectra at 0.075 Hz. The spectra and root mean squared amplitudes of each station suggest that activity of very low frequency tremors beneath Shonai plain at 2004/12/7. The spectra also show dominance of Love waves.

We estimated a source location for a time segment in Tohoku region by grid search as follows: (1) We divided whole records into segments of 1024 s. (2) With an assumption of 1-D structure (Nishida et al. 2008), we calculated synthetic Love and Rayleigh wave excited at an assumed hypocenter. (3) For each time segment, we calculated variance reduction (VR) between the synthetic wave fields and observed records within a 200-km radius of the assumed hypocenter. (4) We calculated VR of Love and that of Rayleigh, and we averaged them from 0.05 to 0.1 Hz. (5) We regarded the minimum of VR as the resultant hypocenter for the segment.

In most periods, the hypocenters were located along coastal regions, which correspond to source of microseisms (high activity regions of ocean swells). The results also show activities of very low frequency tremors beneath Shonai plain. The tremors with duration of several days occurred 3-4 times per a month. The hypocenters were located at a point within an error of about 5 km. Dominance of surface waves suggests that the hypocenters should be shallower than 10 km. Throughout the activities Love wave amplitudes were much larger than those of Rayleigh waves. The observed results suggest that the sources may be related to volcanic activities of Mt. Chokai, but the origin is still unknown.

Keywords: low frequency tremors