論文の内容の要旨

論文題目

Observational study on the slip behavior of deep tremor in western Japan

（西日本における深部微動のすべり過程について）

氏　名　　太　田　和　晃

We study the detailed spatio-temporal behavior of deep tremor in western Japan, by developing and applying a new slip inversion method. Based on the resultant slip process, we discuss on the relationship between slip evolution of tremor and the heterogeneities on the plate interface. We further make a comparison between tremor with very low frequency earthquakes (VLFs) and tremor with no visible VLFs to discuss a source area and an occurrence condition of VLFs.

Although many studies now recognize tremor as shear slips on the plate interface and swarm activities of low frequency earthquakes (LFEs), an ordinary slip inversion analysis cannot be available for tremor due to inadequate knowledge of source locations and Green's functions. Therefore, we construct a new method with a combination of precise locations of plate interface, synthetic template waveforms as substitutes of Green's functions and iterative deconvolution method.

We relocate a large number of LFEs beneath the Shikoku region by using the network cross-correlation (NCC) method. Relocated hypocenters are very concentrated in the depth and show clear slopes in every part of the region. The distributions of LFEs are well fitted by a single plane and we estimate the plate interface based on the distribution.

Next we introduce the synthetic template waveforms as typical waveforms of tremor sources on the plate interface by stacking the seismograms of the LFEs at arranged points on the interface. We prepare the synthetic template waveforms in two regions in the western and central Shikoku. The availabilities of synthetic template waveforms are checked by moment tensor inversion and matched filter analysis. From moment tensor inversion, we obtain the focal mechanism of low-angle thrust faults and moment magnitude of 0.84, which are consistent with typical mechanisms of LFEs. We conduct a matched filter analysis using synthetic template waveforms to examine tremor activity in the western Shikoku. The synthetic template waveforms work well for detection and the detectability is over 10 times larger than that of the ordinary method adopted by Japan Meteorological Agency.

Using the synthetic template waveforms as substitutes of Green's functions, we finally invert continuous tremor waveforms by iterative deconvolution method with a Bayesian constraint. The method is applied to a tremor burst episode for 12 days in the western Shikoku and for 1 day in the central Shikoku region which contains known VLF events. The resultant slip distribution shows a patchy structure and relatively rapid moment releases with durations less than 100 s occur on some patchy regions on the fault. These differences may be associated with the heterogeneities of material properties on the plate interface. The slip distribution of tremor and the centroid of coincidental VLFs are consistent with each other. This suggests tremor associated with VLF is triggered within the source area of VLF. The source size of VLFs in the central Shikoku approximated by slip distribution of tremor, ~5 km in radius, is much larger than the size of patchy slip region of tremor in the western Shikoku. Such difference in source size might possibly control the occurrence of VLFs.