Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SSS29-P03 Room:Convention Hall Time:May 22 17:00-18:30

Shallow very low frequency earthquakes off Sanriku, Japan

MATSUZAWA, Takanori[1*], ASANO, Youichi[1], OBARA, Kazushige[2]

[1]NIED, [2]ERI, University of Tokyo

Activities of shallow very low frequency earthquakes (VLFEs) have been reported around the trench axis of the Nankai subduction zone and the off-Tokachi region (e.g., Obara and Ito, 2005; Asano et al., 2008). In NIED, epicenters of seismic sources including VLFEs are routinely located by an array analysis technique using Hi-net high-sensitivity accelerometers (Asano et al., 2008). Some of the epicenters are located off the Pacific coast of Tohoku, though the number in this region is much smaller than that in the off-Tokachi region. However, these events are not fully examined, as most of these sources have been thought to arise from earthquakes and microseisms. In addition, a slow slip event has been recently reported in the off-Sanriku region (Ito et al., 2010). In this study, we aim to detect VLFEs off Sanriku with a waveform correlation analysis.

The array analysis with Hi-net high-sensitivity accelerometers detected a seismic source off Sanriku at 22h, 10 March, 2011. We estimated a CMT solution of this event using F-net broadband seismometers and Hi-net high-sensitivity accelerometers (Ito and Obara, 2006). The result shows a reverse fault mechanism located at the depth of 18 km with Mw3.5. This event is not clear at the frequency of several Hz, and dominant at 0.05-0.1 Hz, though a typical dominant frequency of regular earthquakes with similar magnitude and close hypocenter is several Hz. Therefore, this event is considered as a VLFE.

Other VLFEs off Sanriku are detected by a waveform correlation analysis adopted in Asano et al. (2010). Averaged cross correlation values are calculated using broadband seismograms at six F-net stations which are bandpass-filtered between 0.02 to 0.1 Hz. The VLFE at 22h, 10 March 2011 are adopted as a template event in this correlation analysis. Epicenters of similar VLFEs are searched within the range of one degree both in the longitudinal and latitudinal direction. If the averaged cross correlation value is over 0.3, we manually check the waveforms and select the events which are not attributed to near- or far-field earthquakes and microseisms.

Applying this technique to the period between 2005 to 14:46, 11 March 2011, we detected two VLFEs on 12 December 2007, one VLFE on 5 July 2009, and another VLFE on 10 March 2011. Activities of VLFEs off Sanriku are much lower than that off Tokachi, where accumulated counts of VLFEs are about six thousand (Asano, 2011). These VLFEs are located at the north of the aftershock area of the M7.3 off-Sanriku earthquake on 9 March 2011. In addition, the activity of regular earthquakes is low in this region. It is not revealed whether the VLFEs occur on the plate interface or within the overriding plate in this region. If we assume that the VLFEs are slip of plate interface, our result implies that frictional property shows stable sliding at this region in a usual state. Shibazaki et al. (2011) numerically reproduced large and great earthquakes which recur at the intervals of one hundred and several hundred years, respectively. In their model, it is assumed that the surrounding region of asperities shows a velocity-strengthening behavior at low and intermediate slip velocity, and strong velocity-weakening at high slip velocity. The detected VLFEs are located at the surrounding region of the asperity of the M 7.3 off-Sanriku earthquake on 9 March 2011, and at the region with large slip of the 2011 off the Pacific coast of Tohoku earthquake. Perhaps, the frictional property assumed in Shibazaki et al. (2011) may be actually important in the seismic cycles of the Tohoku region. A further observation at ocean bottom in this region would reveal the detailed activity of VLFEs.

Keywords: very low frequency earthquake, Off Sanriku