**Japan Geoscience Union Meeting 2010**
(May 23-28 2010 at Makuhari, Chiba, Japan)
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SCG085-P07 Room: Convention Hall Time: May 23 17:15-18:45

# Spectral characteristics depend on the source structure of deep low-frequency earthquakes in subduction zones

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Deep nonvolcanic tremors occurred along the subduction zones in southwest Japan and Cascadia, are considered as ruptures of relatively unstable patches on the plate boundary within the region where slow slip occurs [Ito et al., 2007]. Occurrences of the low frequency earthquakes (LFEs), which are isolated events in tremors [Shelly et al., 2007], are explained as shear slips on the plate interface [Ide et al., 2007a]. It is also observed that the moment rate spectra of the LFEs have a tendency that decay at the inverse proportional to the frequency f, as well as the linear scaling relation between seismic moment and durations of a wide range of slow earthquake events [Ide et al., 2007b]. The relationship between the spectral property and their source dynamics is remained unknown. The aim of this study is to investigate the detailed structure of LFE source to explain the spectral characteristics.
Because those tremor sources migrate following the propagation front of the slow slip events [Obara et al., 2004], it is suggested that the tremors can be triggered by slow slip event. Ando et al. [2009, AGU fall meeting & 2010, This meeting] assumed randomly distributed unstable patches on a fault mimicking a LFE source located on a plate boundary, and a slow slip front is set to pass over the patches in the simulation. LFE source model is composed of unstable patches. These patches are clustered within a large rounded square. Some fluctuations are added to determine the locations and sizes of the patches following a normal distribution.
In this study, we analyzed source spectra dependent on LFE patch size and LFE source size by using the model of Ando et al. [2009, 2010]. The aim of this study is quantitative analysis on the effect of the patch distribution with finer spatial numerical resolution. In the case of one patch in the source, moment rare function become triangular shape, and the moment rate spectra decay $1/f^2$. On the other hand, the sufficiently fragmented source with many small patches showed the plateau shape of moment rate, and the 1/f decay of source spectra. And the source with relatively small patches showed the 1/f decay in low frequency and $1/f^2$decay in high frequency components , the source with relatively large patches showed the $1/f^2$decay in low frequency and 1/f decay in high frequency components. This suggests that we may be able to obtain detailed source structure by analyzing observed LFE source spectra.