Variation of Focal Mechanisms of Low Frequency Earthquakes in Parkfield

*麻生 未季[1,3]、麻生 尚文[2]、井出 哲[1]
*Miki Aso[1,3], Naofumi Aso[2], Satoshi Ide[1]

1. 東京大学大学院理学系研究科、2. 東京工業大学理学院、3. 応用アール・エム・エス株式会社
1. Department of Earth and Planetary Science, The University of Tokyo, 2. Tokyo Institute of Technology, School of Science , 3. OYO RMS Corporation

Tectonic low frequency earthquakes (LFEs) occur at plate boundaries around the world, and considered as local slow deformation. LFEs in subduction zones are found to have low-angle thrust fault mechanisms in southwest Japan [Ide et al., 2007], Mexico [Frank et al., 2013], and Cascadia [Royer and Bostock, 2014]. LFEs along Alpine fault, a transform fault in New Zealand, are known to have right-lateral strike slip mechanism [Baratin et al., 2018]. However, the focal mechanisms of LFEs at Parkfield along the San Andreas Fault zone have not been revealed yet, regardless of the frequent activities. The San Andreas Fault is one of the most matured active faults in the world, especially at Parkfield, and large damaging earthquakes also repeatedly occurred in history. Therefore, many seismologists and geologists have been challenging to reveal the cause of earthquakes and LFEs.
In this study, we estimate the focal mechanisms of 88 LFE families in the catalog of Shelly [2017]. We first stack seismograms of over one million events in the catalog to improve the signal-to-noise (S/N) ratio. P-wave polarities of the stacked waveforms suggest the existence of variations in focal mechanisms of the LFE families.
Then, we evaluate the absolute amplitudes of original seismograms using the stacked waveforms. The SH wave amplitudes are inverted to the focal mechanisms for each LFE family. Specifically, the contributions from source radiation, path attenuation, and site amplification are represented by independent terms based on the assumption of simple ray theory, and estimated by solving a two-step inversion problem. The source terms are utilized to determine focal mechanisms. While most of the focal mechanisms are strike-slip consistent with the San Andreas Fault motion, those for families near the central Parkfield and the family off the surface trace contain large dip-slip (Figure 1 and 2). These variations are consistent with tidal sensitivities of LFEs in Parkfield [Thomas et al., 2012]. Our study reveals regional dip-slip focal mechanisms at first glance to be strike-slip along matured San Andreas Fault.

キーワード：サンアンドレアス断層、パークフィールド、震源メカニズムインバージョン、波形スタック、低周波地震、振幅評価
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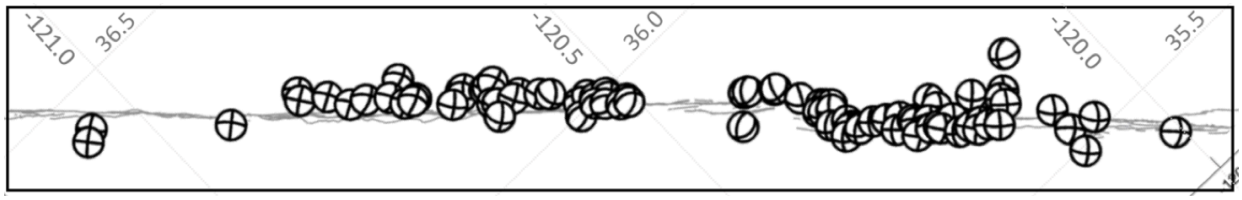

Figure 1. The focal mechanisms of LFE families

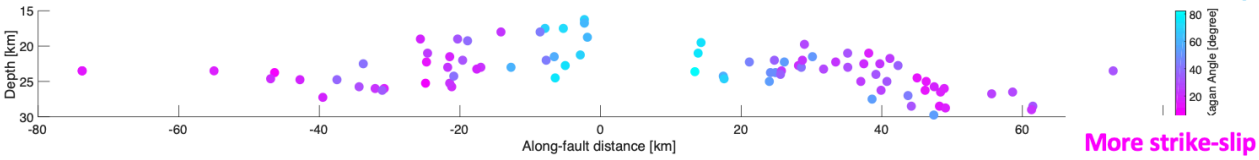

Figure 2. The difference from strike-slip focal mechanism of ordinary earthquake