Focal mechanisms of deep low-frequency earthquakes beneath Kurikoma volcano

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Deep low-frequency earthquakes (LFEs) with dominant frequencies of 2~4 Hz are observed in various regions in Japan. Deep LFEs tend to occur at depth of 20~40 km, which is deeper than the depth of regular crustal earthquakes, and previous studies indicated that focal mechanisms of LFEs have non-double-couple components such as CLVD (Compensated Linear Vector Dipole) and volumetric deformation. This study determines focal mechanisms of volcanic LFEs that occur beneath Kurikoma volcano.

We use S/P amplitude ratios to estimate focal mechanisms of LFEs. Observed amplitudes contain a combined effect of propagation path, site amplification, and incident angle to the free surface, and thus we reproduce P- and S-wave amplitudes at the source by correcting for these effects. We assume four focal models (double couple, single force, CLVD, tensile crack) and determine an optimal model that minimizes AIC calculated from amplitude residuals between corrected and theoretical S/P ratios. In this study, we analyze 5 deep LFEs with M>=1.

The obtained results show that four LFEs occur as CLVD mechanism and one as tensile crack. Since this study uses S/P amplitude ratios only, we cannot assume a combination of two or more focal mechanisms, which prevents us from discussing a detailed physical process of CLVD component. We find that another LFE occurs 15 sec after the tensile crack earthquake, for which the best-fit solution is either single force or CLVD. We infer that a successive occurrence of two LFEs with different mechanisms suggest a transient process of fluid migration at the source.

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