

東北日本で発生する深部低周波地震のスペクトル特性の時空間変動

Spatiotemporal variations of spectral characteristics of deep low-frequency earthquakes in northeastern Japan

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We examined the spatiotemporal variation of peak frequency of deep low-frequency microearthquakes beneath northeastern Japan. The earthquakes are anomalous because they have quite low predominant frequencies than those expected from earthquake magnitude, and they occur well below the cutoff-depths of ordinary inland earthquakes. Thus, the investigation of generation mechanism of low-frequency earthquakes probably leads to the understanding of large inland earthquakes, however, the mechanism has not yet been clarified.

In this study, to get fundamental knowledge about the waveforms of low-frequency earthquakes, we evaluated the predominant frequency between two horizontal components in S-wave part. We then obtained spatiotemporal plots of station-averaged predominant frequencies for thirteen areas from Hokkaido to northern Kanto district. The peak frequency ranges from 1 to 6 Hz, mostly from 2 to 5 Hz. There is no clear dependence of predominant frequency on earthquake location and on the time of occurrence. However, in some areas, there is weak dependence on location. For example, at Mashu in Hokkaido and the Ani area in Akita prefecture, events with lower predominant frequency seem to occur in a deeper part. On the other hand, at Yoteizan area in Hokkaido, clusters including higher frequency events are located in a deeper location. Thus, the predominant frequency does not directly reflect pressure and temperature in the source area. Rather, the result suggests that the frequency is much affected by additional and minute environmental factors such as composition and stress in the source area.

Our previous study has shown the diversity of waveforms of low-frequency earthquakes by grouping events using a waveform cross-correlation. Using a time window immediately after the arrival of the S-wave, it is found that closely located earthquakes tend to form a single group, which suggests a similarity of focal mechanisms among grouped events. However, the value of cross-correlation is much lower than that of ordinary high-frequency events, and many events are not grouped even if the location is near grouped events. The present result of predominant frequency also suggests that focal mechanisms and source processes of low-frequency earthquakes differ from event to event.

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