Source locations of Rayleigh waves in secondary microseisms inferred from polarization analysis of Hi-net data

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Microseisms are energetic ambient seismic wavefield generated by ocean swells, which are categorized into primary (10-14 s) and secondary microseisms (5-7 s). Although observation and application, such as seismic interferometry, of microseisms have been established well, source locations of secondary microseisms still remain uncertain. In the present study, we locate dominant source locations of Rayleigh wave microseisms observed in the Japan islands using Hi-net records. In order to locate microseism source, we first estimate back azimuths of Rayleigh waves in the period of 4-8 s based on polarization analysis. Since fundamental Rayleigh waves, dominating secondary microseisms, generally show retrograde particle motions, back azimuth of Rayleigh waves can be determined without uncertainty of 180 degrees from three component records at single stations. We then search locations explaining the back azimuth distribution, and select source locations with small location errors. The dominant sources of Rayleigh waves mainly distribute in two specific regions: 100-200 km off the coast of Fukushima in the Pacific and off Tottori in the Sea of Japan. The off Tottori sources show a clear seasonal variation, existing only in the winter season. In contrast, the off Fukushima sources are detected stationary. The seasonality is consistent with ocean wave activity in the sea near Japan predicted by an ocean action model WAVEWATCH III. The observation suggests that Rayleigh waves in secondary microseism are dominated by contribution from adjacent sea. The off Tottori and off Fukushima sources are located at an ocean basin with the depth of 1000-2500 m and at shelf slope with the ocean depth of 2000-6000 m, respectively. The oceanic depths are close to the resonance depth of 1500-3000 m for the period of 4-8 s. Improving source locations and investigating their frequency dependence may deepen our understanding of mechanism of microseisms.

Keywords: Microseisms, Surface waves

