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Topography of the inner core boundary inferred from frequency dependent amplitude ratio of PKiKP/PcP

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The inner core boundary (ICB) is an important region for understanding the core dynamics. The amplitude ratio of PKiKP/PcP has been used for the inference of the density jump at the ICB as well as the shear velocity at the top of the inner core. Previous studies, however, were hampered by the large scatters of the PKiKP/PcP ratios, which precluded constraining relevant parameters of the ICB structures. We observe and collect a significant volume of PKiKP waves recorded by a dense network in Japan?Hinet, to examine its frequency characteristics and relevance for understanding the core dynamics in the quasi-eastern hemisphere.

We found clear PcP and PKiKP phases on high-pass filtered seismograms of 9 events with magnitude greater than 5.8 around Japan. The location of these events and the Hinet array covers epicentral distance range from 15 to 45 degrees. After the corrections for source radiation, attenuation in the mantle, the reflection coefficients (RC) at the inner core boundary are inferred from the spectral ratios of PKiKP/PcP. We find that RCs for both 1 and 2 Hz at incident angle (IA) of 10 degrees are close to the values predicted from AK135 and that RCs for 2 Hz are about 2 times larger than those for 1 Hz at IAs greater than 20 degrees. A 2D finite difference simulation involving topography with wavelength and height of 1.5 km can explain the above observation. However, another observation that RCs for both 1 Hz and 2 Hz suddenly decrease at IA of 30 degrees requires further modeling.

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