

Amplitude distribution of sP reflected phase from offshore earthquakes in the Pacific side of Tohoku district

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We observed a prominent phase on vertical seismograms of interplate and intraplate earthquakes offshore Miyagi prefecture with depth ranges from 30 to 60 km. The phase that appears between P- and S-waves is observed widely at stations in the Japan Sea side. Here we examine the waveform and travel times of this phase using Hi-net data and estimate its origin, and discuss potential usage of the phase.

A polarization analysis indicates that the phase has a strike toward the epicenter, nearly vertical dip angle, and large rectilinearity. This indicates that the phase is P-wave coming from the direction of the source. The travel time of the X-phase is proportional to epicentral distance with an apparent velocity of about 7 km/s. This suggests that the reflection/conversion occurs at relatively shallow part. There is no significant azimuthal variation in arrival times of the X-phase, which implies that the plane of reflection/conversion is nearly horizontal. We estimate the position of conversion/reflection by using ordinary hypocenter location method assuming that the phase is P-wave from the conversion/reflection point. The location is near the surface of the coastal area of Miyagi prefecture. The above observational facts of large amplitude, polarization characteristics, apparent velocity, azimuthal variation of arrival times, and the location of conversion/reflection point, are all consistent with an interpretation that the phase is sP reflected phase from the surface. This phase has already found by previous studies and has been used as a depth phase to improve the depth accuracy in hypocenter location and delineate a seismicity pattern along the plate boundary.

Next we investigated amplitude distribution of sP phase. We measured amplitude on RMS envelope as the deviation of smoothly varying envelope. In many cases the amplitude is largest at stations in Akita and Yamagata prefectures, while the amplitude is smaller at stations in the northern and southern part of Tohoku district, and at stations in the Pacific side. The focal mechanisms of these events are reverse faulting with N-S strike. In the case of reverse faulting earthquake with E-W strike, the area of large amplitude shifts to the northern part of Tohoku district. This indicates that the amplitude distribution of sP phase depends on focal mechanisms. Thus the amplitude of sP phase has a potential usage to determine focal mechanisms of offshore earthquakes, which is difficult from the P-wave polarization only.

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