

Remarkable later phases on seismograms from intermediate-depth earthquakes in the Tohoku area

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We have been studying the characteristics of seismic waves from intermediate-depth earthquakes in order to detect high attenuation region in the Tohoku area, northeastern Honshu, Japan. In the process of the study we found remarkable later phases arriving after direct S waves.

The wave train of the later phases continues for several seconds and its amplitude is larger on horizontal components than that on the vertical component. Earthquakes that show the later phases distribute over the studied area (37-40N). The phases are remarkable when direct S waves are highly attenuated. The phases are remarkable when direct S waves are highly attenuated. They can also be recognized on records with distinctive direct S waves if we compare seismograms among stations. The phases arrive earlier at stations located near the Pacific coast than inland (western) stations. They seem to propagate toward the west.

We picked arrivals of the later phases on the envelope of rms amplitude of the wave records. By using an array constituted by adjacent stations, we estimated arriving direction and apparent velocity. When the distance in the NS direction of an epicenter from an array is small, the later phase arrives from east with apparent velocity of 4-5km/s. The takeoff direction of the later phases is estimated based on arrival times at the same station from sources that are located in rather small area and can be regarded as a source array. The takeoff angle measured from upper vertical is small for sources located near the Pacific coast, and is large for inland sources. Considering these characteristics, we think that the later phase propagates along the subducted Pacific plate toward the Pacific coast, and reflected or scattered in the region near the coast. Travel times calculated along this ray path roughly coincides with observation.