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ガイド波を用いて推定した海洋リソスフェアの地震学的構造
Seismic structure of the oceanic lithosphere inferred from guided wave

志藤 あずさ [1*], 末次 大輔 [1], 古村 孝志 [2], 杉岡 裕子 [1], 伊藤 亜妃 [1]
SHITO, Azusa[1*], SUETSUGU, Daisuke[1], FURUMURA, Takashi[2], SUGIOKA, Hiroko[1], ITO, Aki[1]

[1] 独立行政法人海洋研究開発機構 地球内部ダイナミクス領域, [2] 東京大学地震研究所
[1]IFREE, JAMSTEC, [2]ERI, University of Tokyo

Seismological observation using Broad-Band Ocean Bottom Seismometers (BBOBSs) was conducted in the northwestern Pacific from 2007 to 2008 and from 2010 to 2011. In the BBOBS data, unusual phase generated by events in the subducting Pacific plate were recorded universally. The phase shows some prominent features; large negative travel time anomaly (~ 10 %), high-frequency content (> 10 Hz), and long coda for both P and S waves and the effect is much stronger for P wave. These features indicate that the unusual phase is guided wave traveling mainly in the oceanic lithosphere. The guided wave was previously called as Po/So waves and was studied actively from the 1970s to 1990s. It is now generally believed that these phases travel efficiently through the oceanic lithosphere. However, the mechanism of generation and propagation of the phases are still controversial.

We conduct travel time analysis of the guided wave. Both the guided wave and the direct wave are contained in each record and the guided wave is observed as a later phase in most case. We pick the onsets of the guided wave and the direct wave manually in high-pass filtered record with the corner frequencies of 10 Hz and 0.5 Hz, respectively. The travel time interval of the two phases changes systematically depending on the focal depth, the epicentral distance, and the azimuth. The apparent velocity of the guided P-wave varies from 7.8 to 8.6 km/s depending on the azimuth. The azimuth of the maximum velocity is north-south direction. These results are consistent with the previous explosion experimental studies and indicate that the guided wave travel horizontally in the oceanic lithosphere.

From the analysis of waveform observed at the eastern seaboard of northern Japan and numerical FDM simulation of seismic wave propagation, Furumura and Kennet [2005] demonstrate that the guided wave travelling in the subducting plate is produced by multiple forward scattering of high-frequency seismic waves due to small-scale heterogeneity in the plate structure. We apply this method to demonstrate the guided wave observed by the BBOBS array. This will help us to understand generation and propagation mechanism of the guided wave and the seismic structure of the oceanic lithosphere.