Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS24-06 Room:303 Time:May 20 11:00-11:15

Computer simulation of high-frequency Po/So propagation in the oceanic lithosphere

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The phases Po/So are very distinctive high-frequency signals travelling often more than 1000-3000 km through the oceanic lithosphere and recorded at the ocean bottom seismographs with a long coda. We demonstrate that such Po/So signals are developed by multiple forward scattering of high-frequency body P and S wave in heterogeneous oceanic lithosphere based on the analysis of observed set of waveforms and finte-difference simulation of high-frequency seismic wave propagation in heterogeneous structures.

An important component of the propagation is provided by reverberation in the water column and sediments linked to P and S propagation in the oceanic lithosphere. The nature of the observed Po and So phases with high frequencies and long coda is well represented by multiple forward scattering in a lithospheric structure with and quasi-laminate heterogeneity with horizontal scales much larger than vertical.

Despite the generally good propagation of Po/So to stations in the western Pacific such as from the Japan subduction zone to the Wake island ocean bottom stations near Tonga, the propagation in eastern Pacific, e.g., to the H2O station on an old telephone cable between Hawaii and the mainland USA is rather poor for So (Kennett, Zhao and Furumura, 2009). Such poor transmission of the high-frequency Po/So signals along the young ($<$ 25 Ma) oceanic plate can be explained by the ineffective propagation of high-frequency signals in a thinner lithosphere with influence also from oblique propagation across major transform fault systems in the eastern Pacific with changes in lithospheric thickness.