

SSS015-P08

Room: Convention Hall

Time: May 27 17:15-18:45

Deep 3-D velocity structure under the Japan Islands revealed by teleseismic data

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So far many studies have been made to investigate the 3-D seismic velocity structure under the Japan Islands by using local earthquake data. However, few studies were made by using teleseismic data for the deeper structure under Japan. Teleseismic data are very useful because they contain information on the structure beneath the subducting Pacific slab as well as the depth extension of the subducting Philippine Sea slab, which are still not well known. In this work we have determined a detailed 3-D velocity structure down to 700 km depth under the Japan Islands. In this study we adopted the tomography method of Zhao et al. (1994). We used about 397,000 travel time data from 1180 local events occurred from 1998 to 2007. We also used about 34,000 residuals from 333 teleseismic events recorded by the seismic stations of J-array, JMA and Hi-net from 1988 to 2004 (Zhao et al., 1994; Abdelwahed and Zhao, 2007). In this work we newly collected about 11,000 P-wave arrivals from seismograms of 27 teleseismic events recorded by the Hi-net from 2001 to 2007. We used relative travel-time residuals for the teleseismic data. The iasp91 1-D Earth Model was used to calculate theoretical travel times and relative travel-time residuals.

Our results show the following features. (1) In the Tohoku district, mantle-wedge low-velocity anomalies extend westward under the Japan Sea down to about 200 km depth. (2) In the Chugoku district, a high-velocity zone is visible under the Japan Sea down to 350 km depth, which may represent the subducting Philippine Sea slab. (3) In the Kyusyu district, a high-velocity anomaly which corresponds to the subducting Philippine Sea slab extends down to 500 km depth, indicating the presence of an aseismic slab under Kyusyu. (4) Under SW Japan low-velocity zones are visible at 400 ~ 500 km depths above the Pacific slab up to the Philippine Sea slab, which may be caused by the deep dehydration of the Pacific slab. (5) Low-velocity zones are detected under the Pacific slab, which may indicate a hot upwelling from the deeper mantle.

Reference

Abdelwahed, M. F. and Zhao, D., 2007: Deep structure of the Japan subduction zone. *Phys. Earth Planet. Inter.* 162, 32-52.

Zhao, D., A. Hasegawa, H. Kanamori (1994) Deep structure of the Japan subduction zone as derived from local, regional and teleseismic events. *J. Geophys. Res.* 99, 22313-22329.