# Examination of later phases on seismograms of intraslab earthquakes in southwest Japan

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Later phases on seismograms are generated by reflection and/or conversion of seismic waves at velocity discontinuities. Many distinct later phases are observed after initial P and S phases on seismograms at local stations for intraslab earthquakes beneath southwest Japan. Miyoshi and Ishibashi (2007) interpreted that three distinct later phases (epicentral distance, 150-300 km) for intraslab earthquakes were pPmP, sPmP, and sSmS, which were reflected at free surface and island-arc Moho discontinuity. In the present study, we examine the features of these phases at the epicentral distance of 100-300 km more in detail and re-examine their origin. We investigate the NIED's Hi-net seismograms of intraslab earthquakes which occurred beneath southwest Japan from October, 2000 to May, 2005 (depth; 30-70km, M4-7).

We pick up X1 and X2 phases between P and S, and X3 phases after S. The features of each phase are as follows: 1) The apparent velocities of P and S are 7.9 and 4.5 km/s, respectively. Those of later phases, for X1, 6.8, for X2, 6.3 and for X3, 4.1 km/s at the 200-300km epicentral distance. 2) X1 and X2 phases are predominant in radial components, but X3 phases have no predominant directions. 3) Travel times of X1, X2, and X3 phases depend on focal depths of earthquakes. Based on these features, we think the interpretation by Miyoshi and Ishibashi (2007) is basically appropriate.

However, it is difficult to interpret that X1 and X2 phases at the epicentral distance of about 100-150 km are pPmP and sPmP, respectively, because of their apparent velocities and travel times, although their general features are similar to pPmP and sPmP. To clarify the origin of these phases, we calculated theoretical travel-times by trial and error method. A possible interpretation is that X1 is pPxP, reflected at free surface and the Conrad discontinuity or a reflector within the lower crust, and X2 is sPxP, P wave converted from S at free surface and reflected at the Conrad discontinuity or a reflector within the lower crust.

Acknowledgements: We used Hi-net waveform data by NIED and JMA's hypocenter database. We are grateful to them for providing valuable data.