One-dimensional shear wave velocity structure for the western Taiwan from teleseismic Rayleigh wave

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Abstract

A well-constrained one-dimensional shear wave velocity structure in the western Taiwan was estimated from the fundamental Rayleigh wave in period form 14 to 150sec in out study.

The teleseismic events occurred with depth less than 100 km and the surface-wave magnitude larger than 6.5, and recorded by the BATS stations in the west Taiwan with hypocenter distance from 30° to 90° were selected for estimation of phase delay. An array analysis was applied to the Rayleigh wave for determination of the regional phase velocity for individual given period. Before that a nearest station located in the survey area was adopted as the reference station for specific event to estimate the phase-delay time with other stations. There will be some error form the azimuth deviation between the target and reference stations but is insignificant. Then, the array analyses of phase-delay time between pairs for all events were taken to evaluate the average phase velocity and the standard deviation for individual period in the range 14-150 sec. The standard deviation of the measured phase velocity is much larger when the period less than 20sec. This error maybe caused by more sensitive to the local anomaly and more difficult to correct the 2π factor in the phase calculation for short-period signals.

One-dimensional S-wave velocity down to 200 km was inversed from the dispersion curve obtained in the west Taiwan. To diminish the limitation of discontinuity locations from the initial model, we used a much smoothing initial model with 5 km thickness of each layer in the inversion. The model shows high velocity about 4.57 km/s in 50 km and the lower velocity zone with velocity about 4.25~4.35 km/s in the upper mantle. In depth of 30-40 km a notice velocity gradient decrease occurs, and then we regard the depth as the Moho discontinuity location. To ensure the location of the Moho discontinuity from the inversed model and dispersion data, forward modeling was adopted. In the forward modeling the average crustal s-wave velocity and thickness of the crust were perturbed to estimate the misfit

between the theoretical and measured phase curve, while all other parameters were fixed. The optimal parameter, crust thickness with 35 km and crustal velocity about 3.47 km/s, is obtained when the misfit reaches minimum in this study. The inversed s-wave model of the west Taiwan from long-period Rayleigh wave can provide information down to upper mantel and useful to understand the regional tectonic.

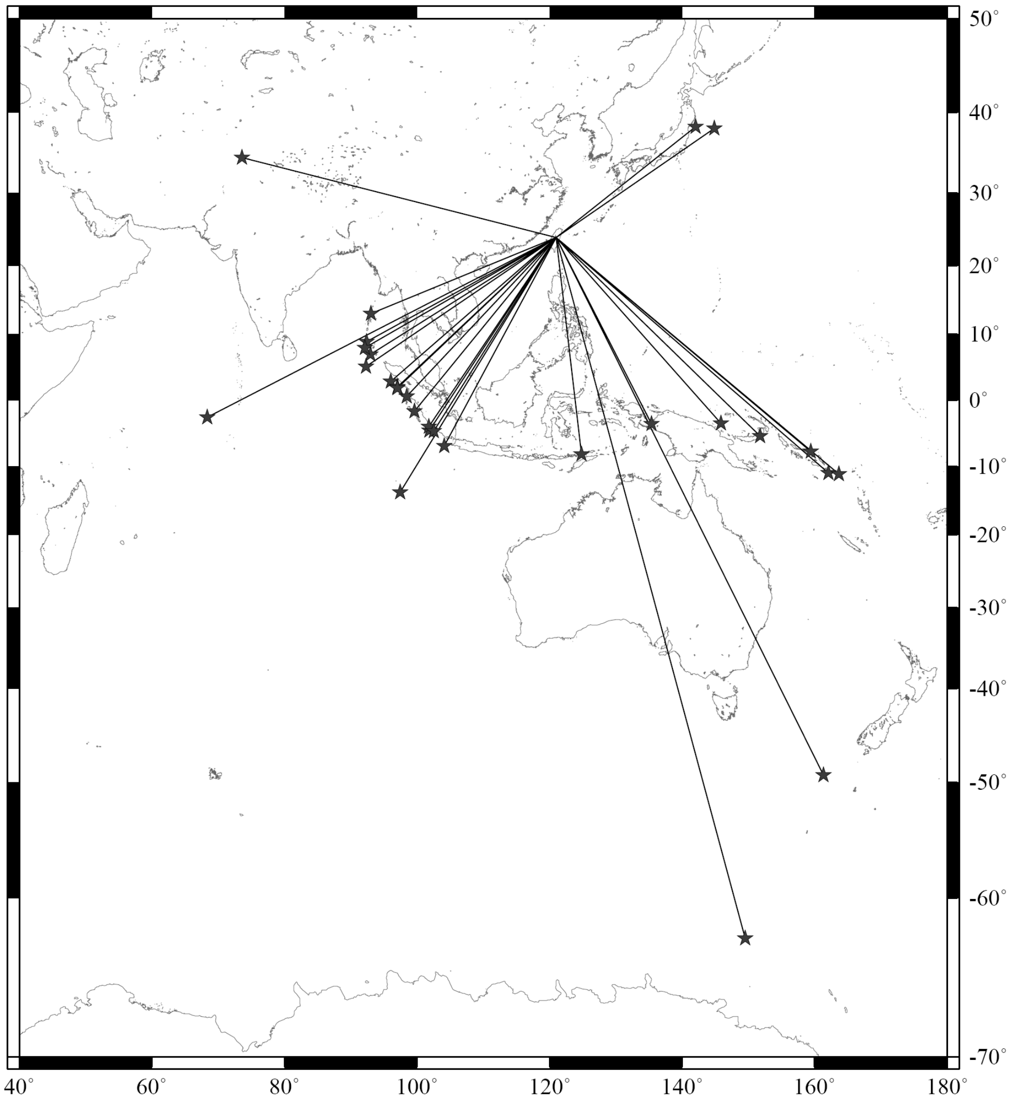

Figure 1. Hypocenters of 28 teleseismic events (star) from 1998 to 2005 and great circles between the epicenters and stations for events used in this study.

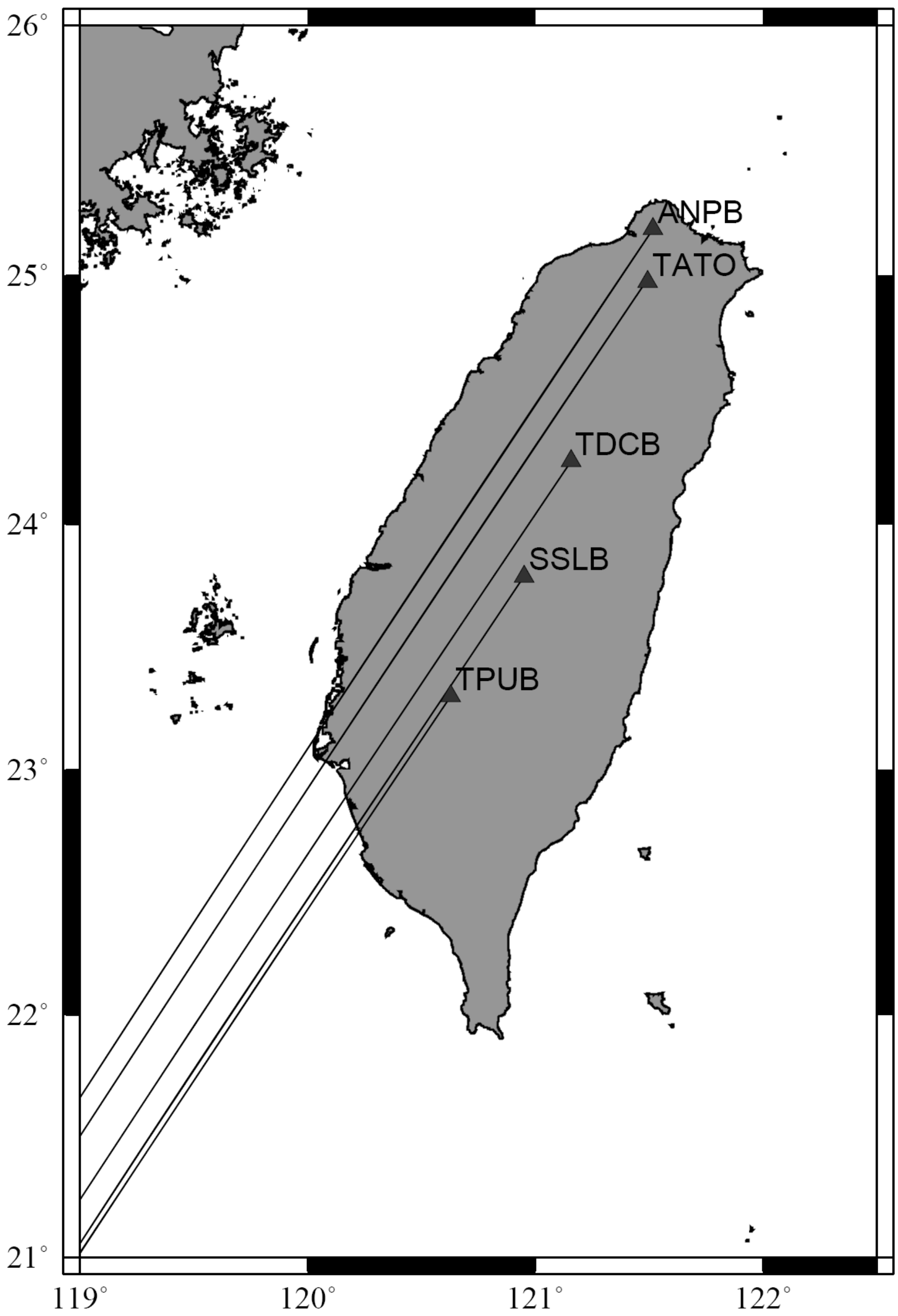

Figure 2. Example for determination of the station pair using the phase-delay time measurement. The paths (solid line) from the event located in 149.53° E and 62.88° S to the stations (triangle) are almost parallel to each other. The nearest station TPUB is regarded as the reference station for the event to estimate the phase-delay time of SSLB-TPUB, TDCB-TPUB, TATO-TPUB and ANPB-TPUB station pairs.

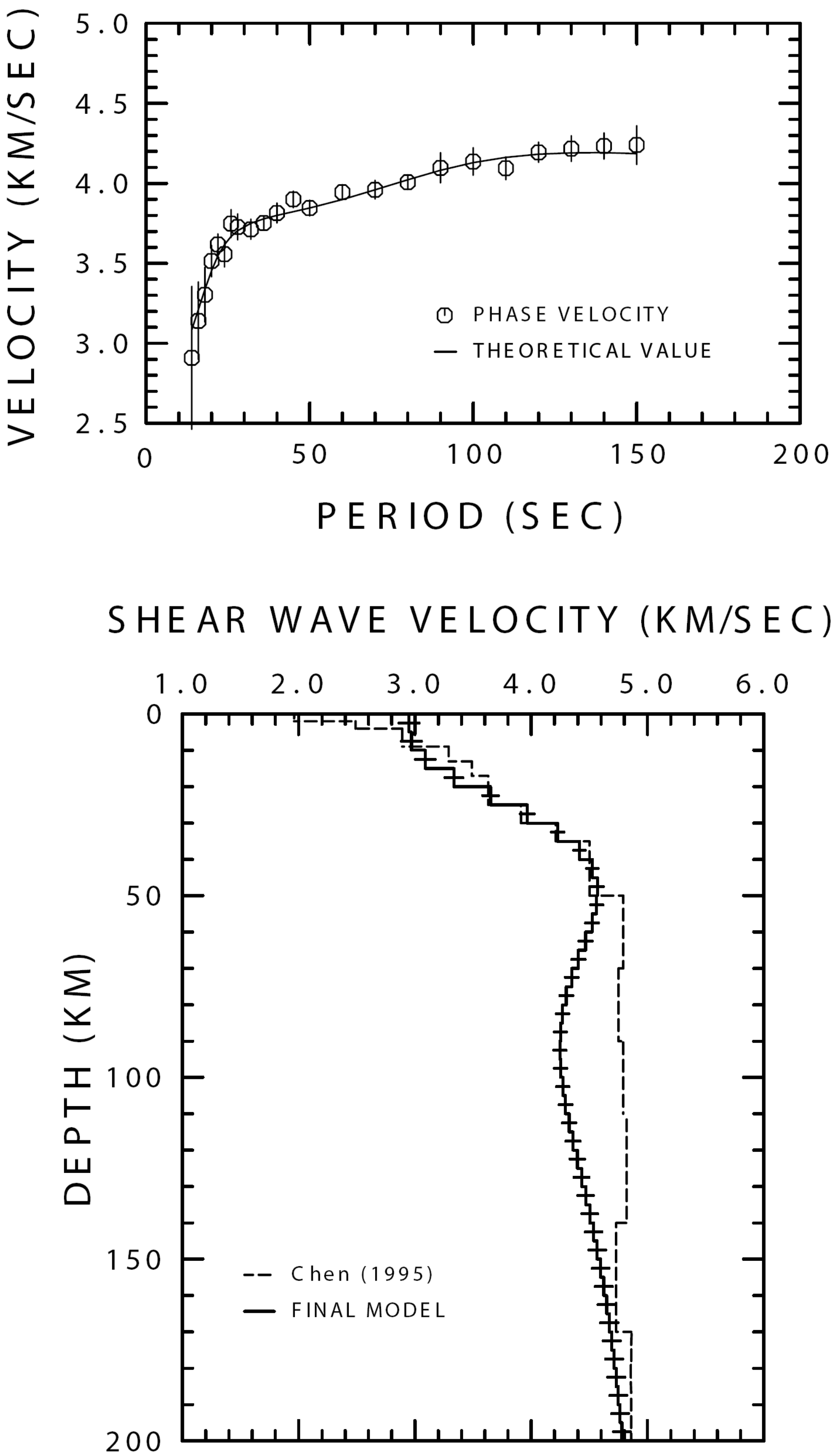

Figure 3. 1-D velocity model obtain by the inversion of the dispersed phase velocity (solid line). The dash line shows the average velocity from the 3-D velocity model by Chen (1995).