Regression function of depth versus Ts-Tp travel-time difference based on VSP (II)

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The sedimentary thickness from surface down to bedrock in the eastern Kanto basin has been studied by the All-pass Receiver Functions (APRF) combined with VSP information. On average, with about 20 records at each station, over 222 strong motion stations from K-net, KiK-net, and SK-net, have been used to calculate the travel time differences (Tps-p) between converted PS wave and P wave.

A dozen measurement of VSP has been carried out on deep-wells down to 2000 meters by NIED in the last decade. The equalization between Tps-p and Ts-Tp has been verified by Hao et al. (2007).

Last year, we had clean up five sets of regression functions for the sedimentary thickness versus the travel time differences of direct P and S waves (Ts-Tp) by re-utilizing the deep-well's VSP data. But the puzzle of large variation of the regression functions remained (Hao et al. 2007). In order to solve the puzzle, we have collected on another 10 sets of VSP data around Kanto basin. Based on the property of physical parameters Ts-Tp and Fujiwara et al. (2007), we divided regression functions into three groups.

Group A is located at the center of deepest Kanto basin, with a radius of 30-40 km area. There is a distinguished velocity contrast with geological boundary under the sedimentary basin. (A-2) is a representative function over other three because it's the thickest sediments, and having similarity with HSN(A-3), NRT(A-4) and TKB(A-1). The most of Tps-p from APRF have been converted to the basin depth by (A-2). Results have been confirmed at some areas as long as where was available information of deep-wells or seismic reflections.

TKB: $D=0.5297(Ts\text{-}Tp)^2 + 0.4122(Ts\text{-}Tp)$; (A-1)
CHB: $D=0.562(Ts\text{-}Tp)^2 + 0.2564(Ts\text{-}Tp)$; (A-2)
HSN: $D=0.4579(Ts\text{-}Tp)^2 + 0.3265(Ts\text{-}Tp)$; (A-3)
NRT: $D=0.4091(Ts\text{-}Tp)^2 + 0.3092(Ts\text{-}Tp)$; (A-4)

Group B is located at the surrounding of the Kanto basin including the upheaval of Boso peninsula with higher velocities, where is different sedimentary environments with the central Kanto basin area.

YRO: $D=1.012(Ts\text{-}Tp)^2 + 0.6051(Ts\text{-}Tp)$; (B-1)
YKH: $D=0.9797(Ts\text{-}Tp)^2 + 0.3267(Ts\text{-}Tp)$; (B-2)
FUT: $D=0.8739(Ts\text{-}Tp)^2 + 0.2298(Ts\text{-}Tp)$; (B-3)
EDS: $D=0.5276(Ts\text{-}Tp)^2 - 0.0662(Ts\text{-}Tp)$; (B-4)

Group C is located at out of the Kanto basin, further than Group B, including mountain areas with higher velocities. It has the thickest sediment while the same Ts-Tp.

NSN: $D=6.3128(Ts\text{-}Tp)^2+0.4197(Ts\text{-}Tp)$; (C-1)
YKM: $D=3.2105(Ts\text{-}Tp)^2+0.7013(Ts\text{-}Tp)$; (C-2)
YSZ: $D=2.6675(Ts\text{-}Tp)^2+0.0891(Ts\text{-}Tp)$; (C-3)
MOK: $D=2.3222(Ts\text{-}Tp)^2-0.0352(Ts\text{-}Tp)$; (C-4)
HDK: $D=1.2991(Ts\text{-}Tp)^2+0.4103(Ts\text{-}Tp)$; (C-5)
ATG: $D=1.3055(Ts\text{-}Tp)^2-0.0247(Ts\text{-}Tp)$; (C-6)
TKZ: $D=0.8176(Ts\text{-}Tp)^2+0.2534(Ts\text{-}Tp)$; (C-7)

Based on these regression functions, the basement depth can be estimated reasonable by using Tps-p from receiver functions.

Reference:

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