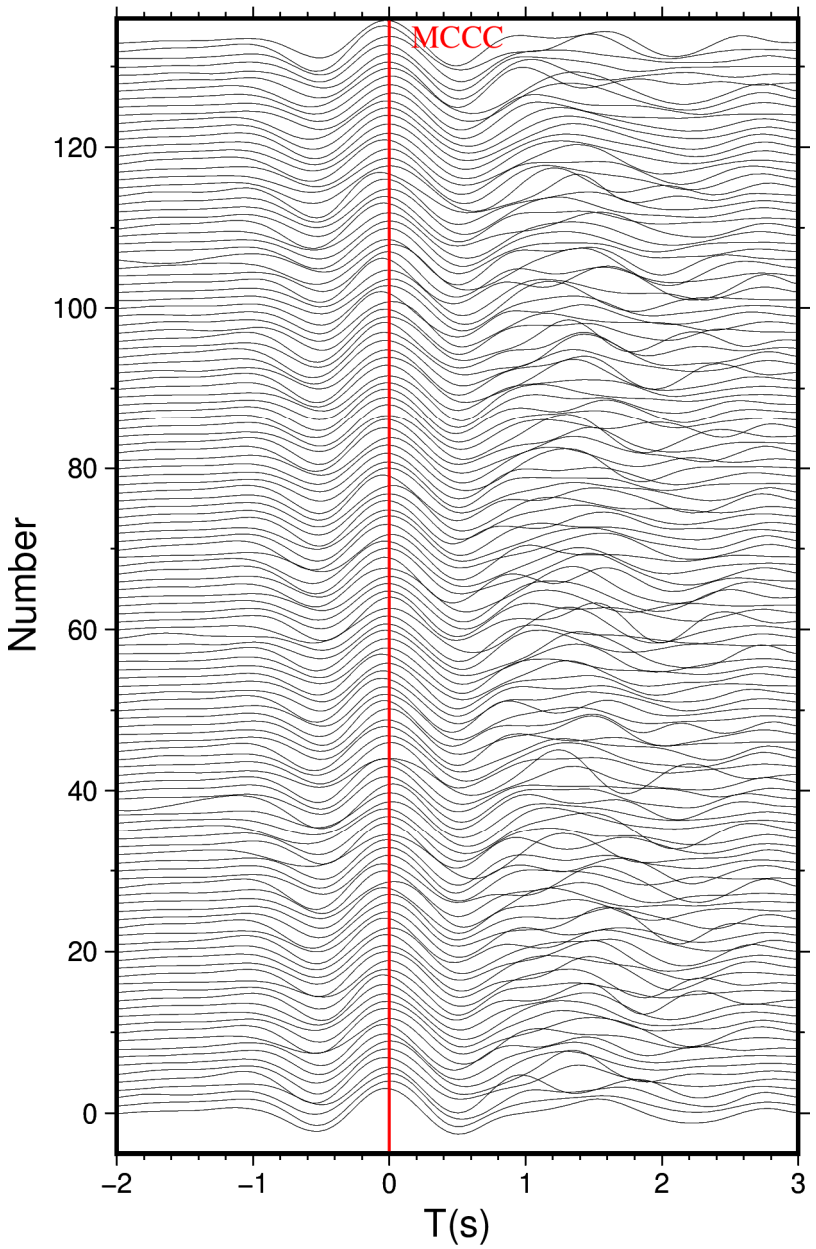

Figure S1. A teleseismic event used for cross-correlation analysis. The earthquake occurred on 27 December 2006, with a magnitude of 6.0. Its epicenter was located at latitude -5.78° and longitude 154.43°, with a focal depth of 355 km.

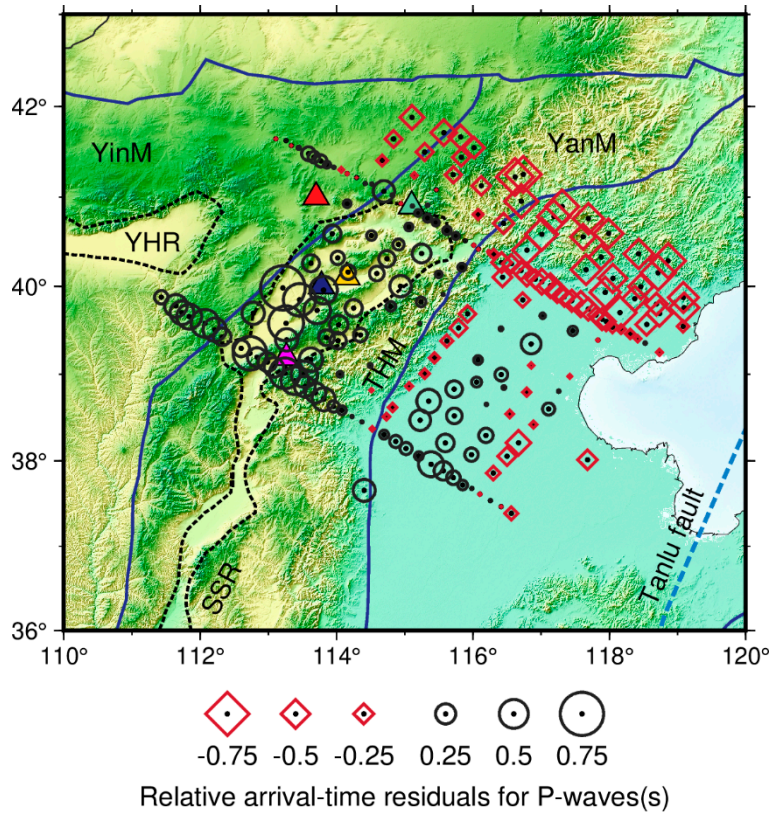

Figure S2. Distribution of mean relative travel-time residuals at each station. Black circles and red squares represent delayed and early P-wave arrivals, respectively. The scale for the residuals is shown at the bottom. Colored triangles show the distribution of Cenozoic basalts. SSR: Shanxi-Shaanxi Rift; YHR: Yinchuan-Hetao Rift; THM: Taihang Mountains; YanM: Yan Mountains; YinM: Yin Mountains.

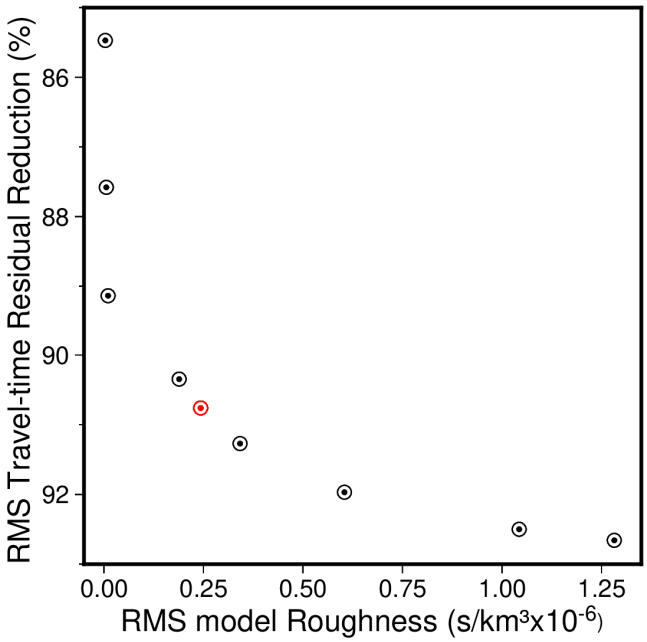

Figure S3. Trade-off curve between model roughness and residual reduction with varying damping and smoothing parameters. The red dot indicates the optimal smoothing and damping values.

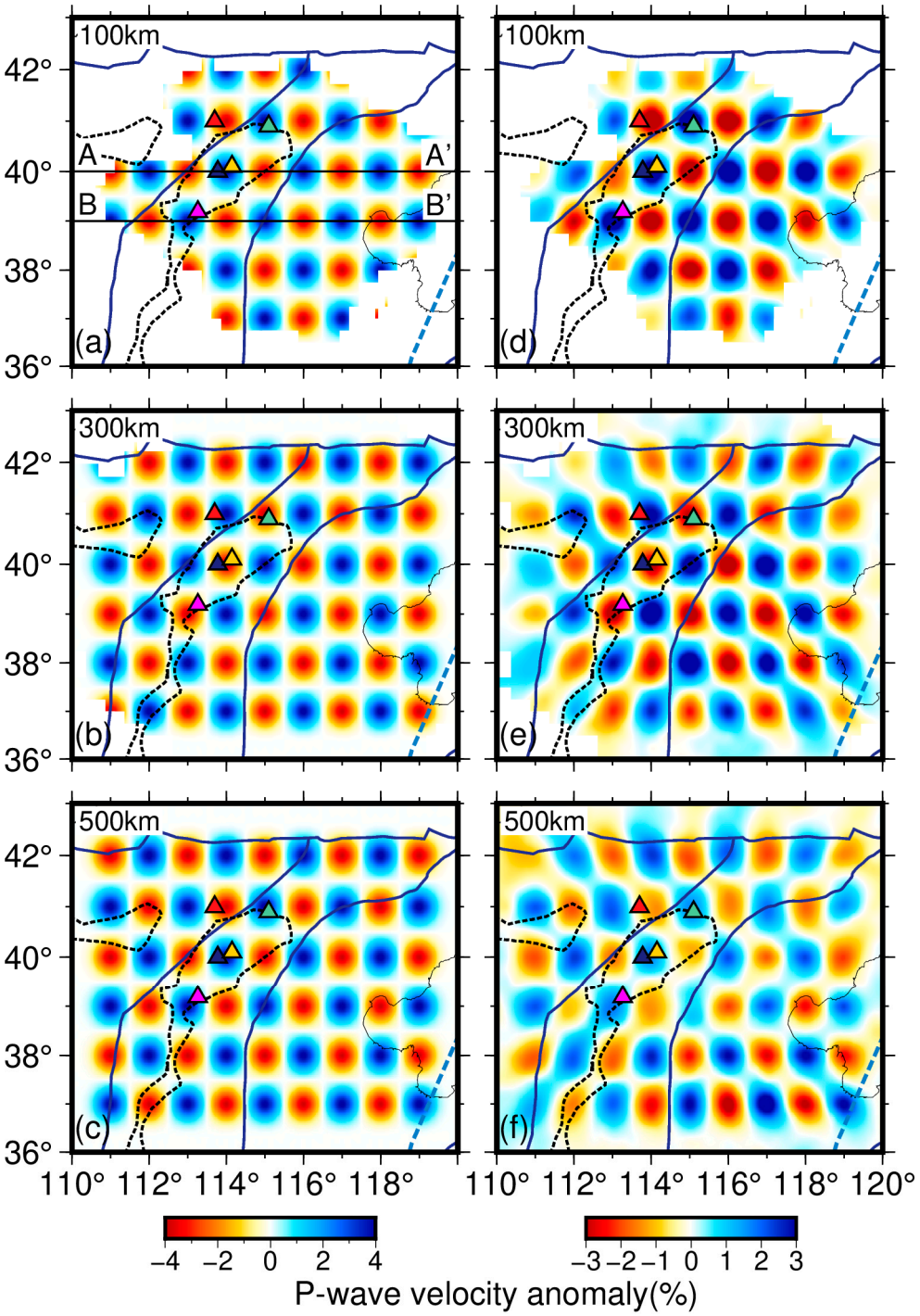

Figure S4. Checkerboard resolution tests for P-wave model. (a–c) Depth slices of the input checkerboard model at 100, 300, and 500 km depth, respectively. Gaussian spheres with a 60 km radius and ±4% peak velocity anomaly are distributed in layers of 100, 300 and 500 km depth. (d–f) The retrieved checkerboard model at 100, 300, and 500 km depth, respectively. Blue solid lines show the NCC boundaries. Blue and black dashed lines mark the Tanlu fault and rifts, respectively. Colored triangles show the distribution of Cenozoic basalts (Figure 1).

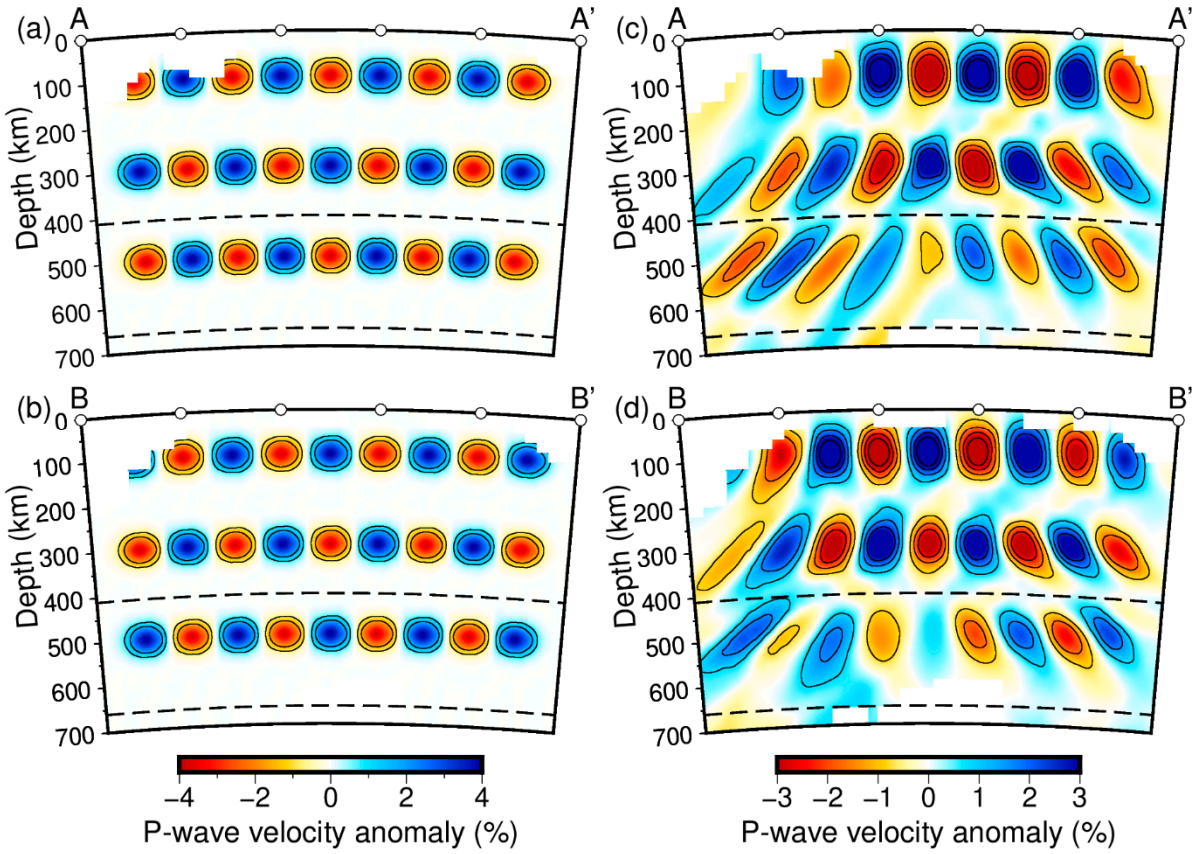

Figure S5. (a,b) Cross sections of the input checkerboard model along profiles A–A' and B–B'. (c,d) Cross sections of the retrieved checkerboard model along profiles A–A' and B–B'. Black dashed lines indicate the 410 km and 660 km discontinuities.

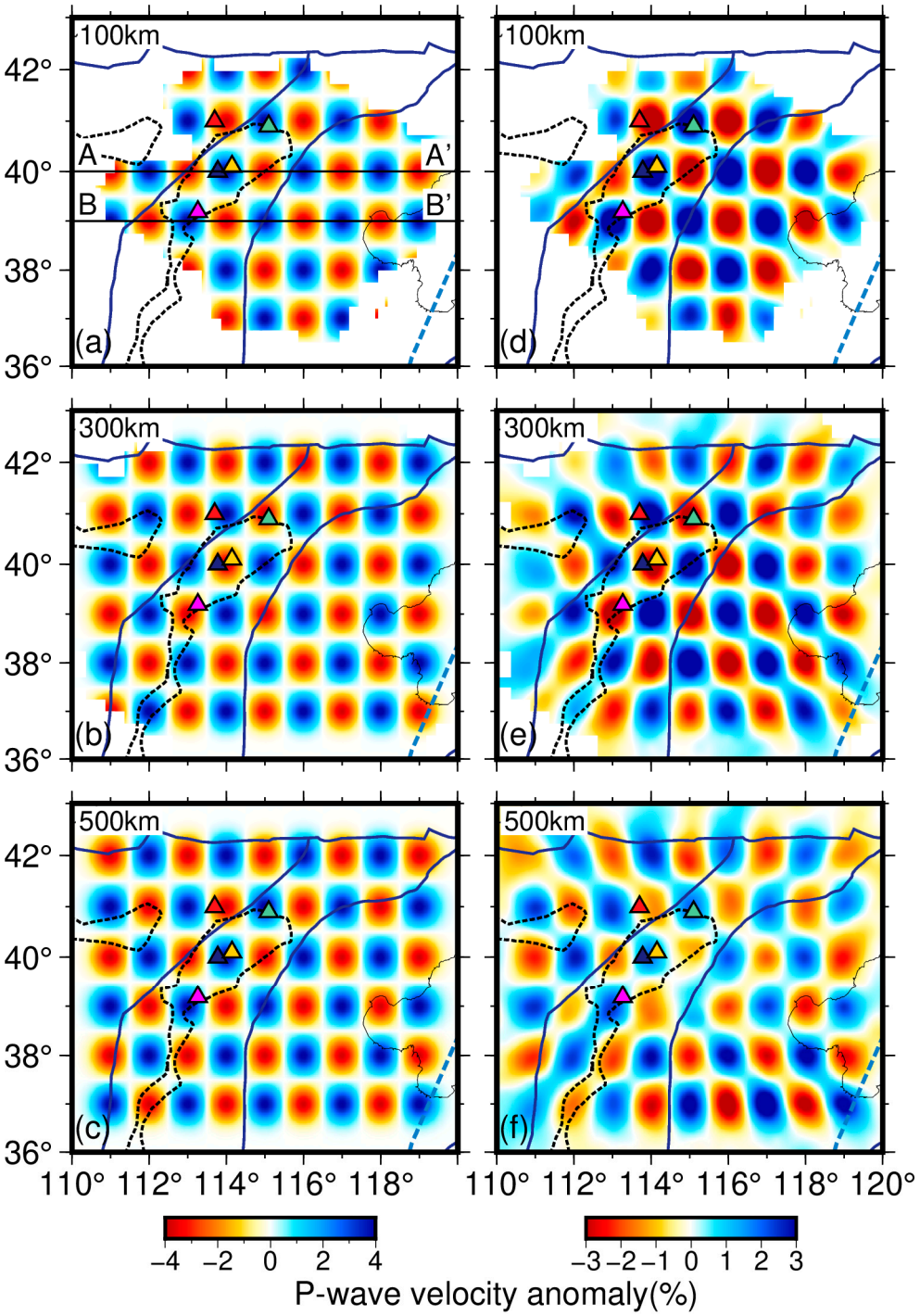

Figure S6. Checkerboard resolution tests for P-wave model. (a–c) Depth slices of the input checkerboard model at 100, 300, and 500 km depth, respectively. Gaussian spheres with a 70 km radius and ±4% peak velocity anomaly are distributed in layers of 100, 300 and 500 km depth. (d–f) The retrieved checkerboard model at 100, 300, and 500 km depth, respectively. Blue solid lines show the NCC boundaries. Blue and black dashed lines mark the Tanlu fault and rifts, respectively. Colored triangles show the distribution of Cenozoic basalts (Figure 1).

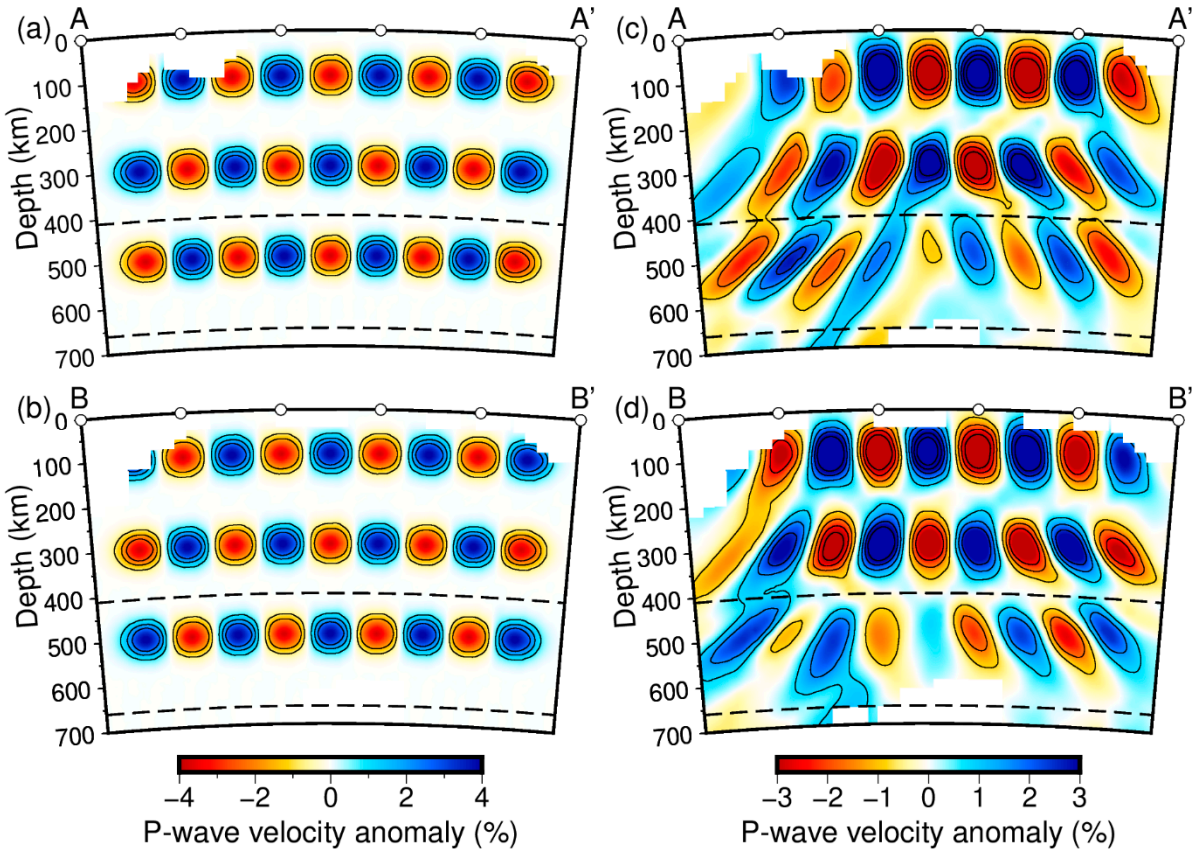

Figure S7. (a,b) Cross sections of the input checkerboard model along profiles A–A' and B–B'. (c,d) Cross sections of the retrieved checkerboard model along profiles A–A' and B–B'. Black dashed lines indicate the 410 km and 660 km discontinuities.