Geosphere

Supporting information for

Mantle structure beneath the incipient Okavango rift zone in southern Africa

by Youqiang Yu[1,2], Kelly H. Liu[2], Zhouchuan Huang[3], Dapeng Zhao[4], Cory A. Reed[2], Moikwathai Moidaki[5], Jianshe Lei[6], and Stephen S. Gao[2]

[1]State Key Laboratory of Marine Geology, Tongji University, Shanghai 200092, China.

[2]Geology and Geophysics Program, Missouri University of Science and Technology, Rolla, Missouri 65409, USA.

[3]School of Earth Sciences and Engineering, Nanjing University, Nanjing 210023, China.

[4]Department of Geophysics, Tohoku University, Sendai 980-8577, Japan.

[5]Department of Physics, University of Botswana, Gaborone, Private Bag 0022, Botswana.

[6]Key Laboratory of Crustal dynamics, Institute of Crustal Dynamics, China Earthquake Administration, Beijing 100085, China.

E-mail: sgao@mst.edu

Introduction

This supporting information provides examples of original seismograms, histogram of relative travel-time residuals, CRT results with different grid intervals, RRT results and more synthetic tests.

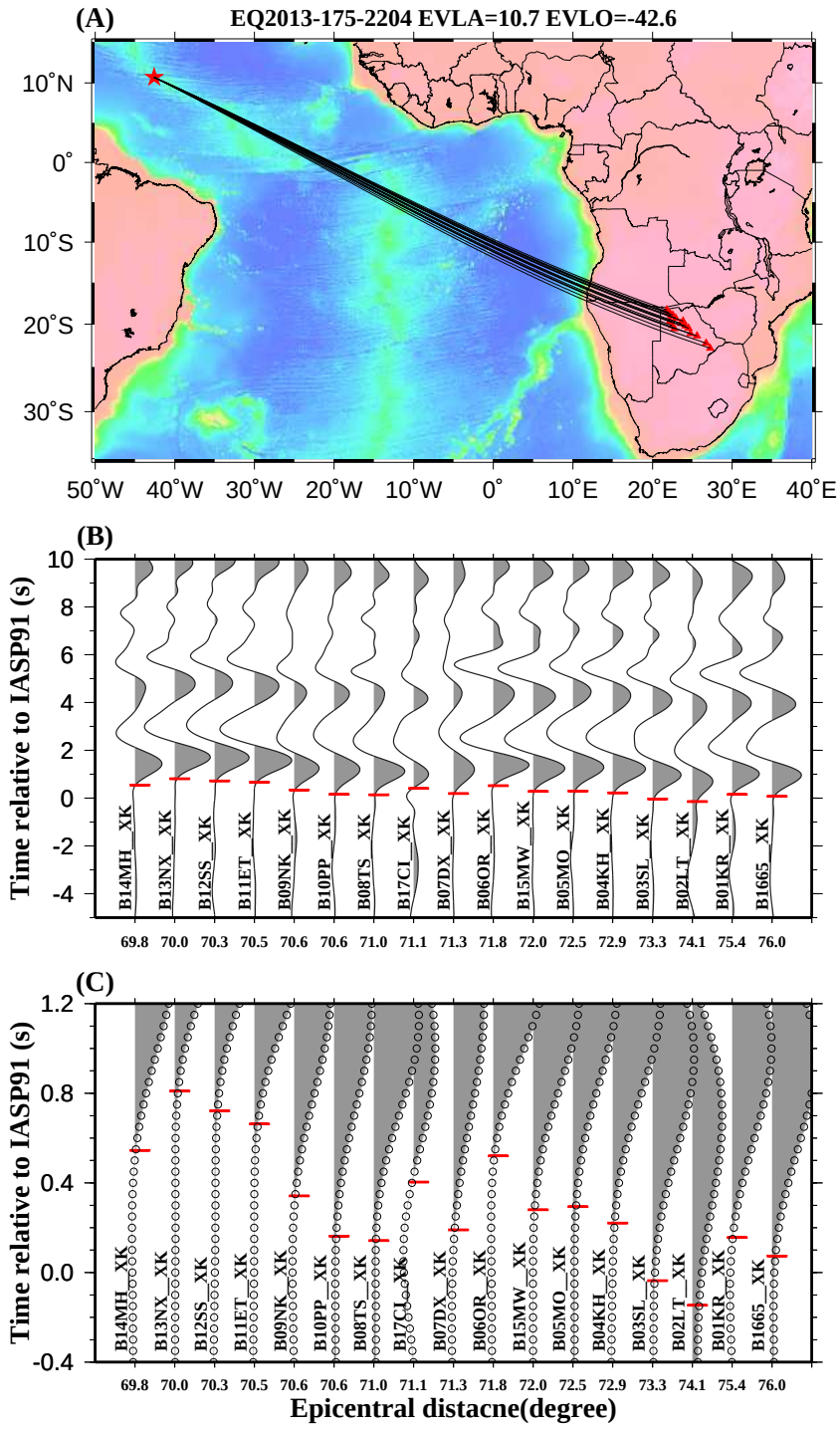

Figure S1. Examples of picking original seismograms for one event occurring in 2013. (A) Distribution of seismic stations (red triangles) and hypocenter (star). (B) Original seismograms with hand-picked P wave arrivals (horizontal red bars). (C) Same as (B) while enlarged in the time window of -0.4s∼1.2s.

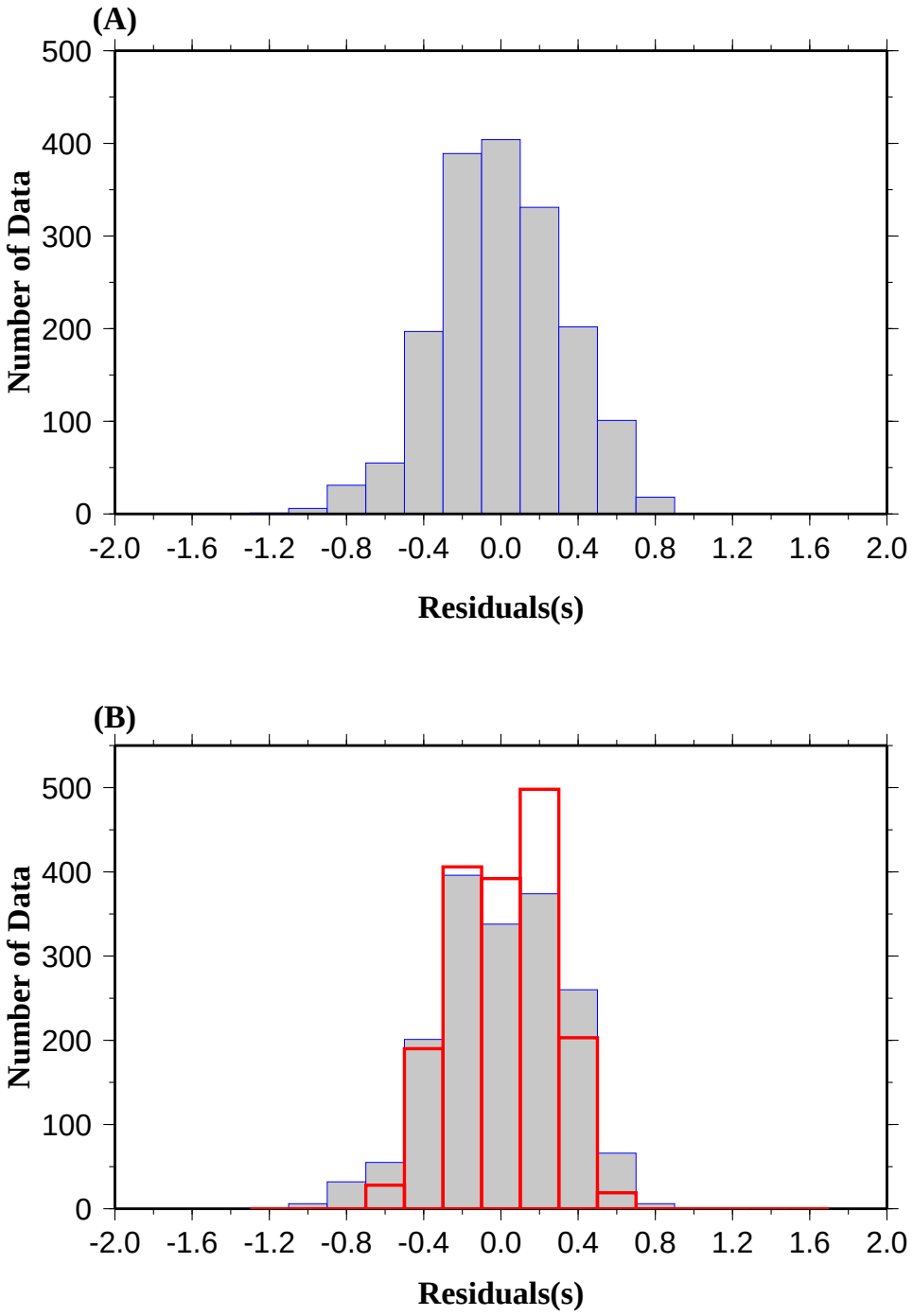

Figure S2. Histogram of relative travel-time residuals (A) before crustal correction; (B) after crustal correction (gray columns) and the tomographic inversion (red thick lines).

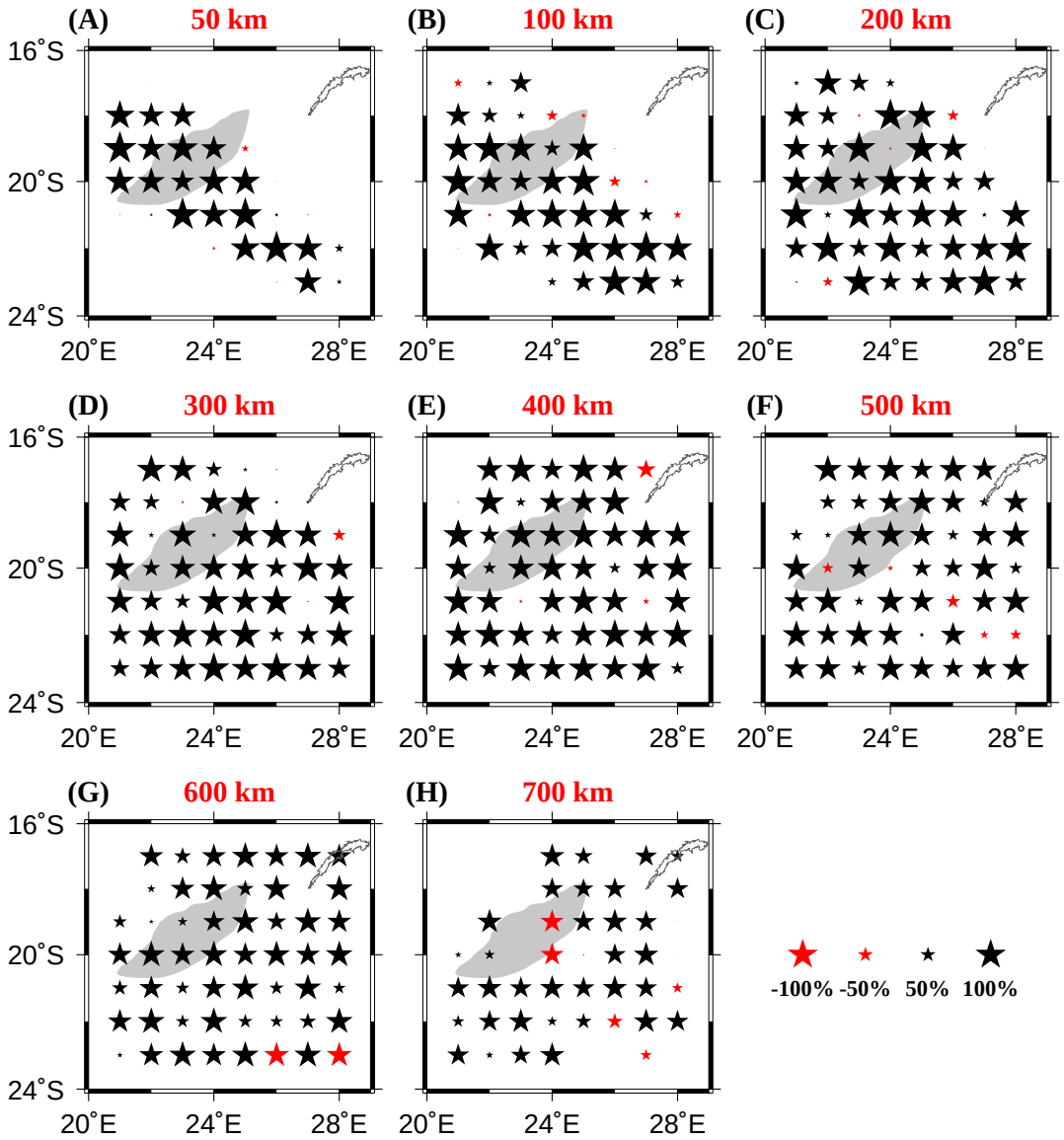

Figure S3. Results of a checkerboard resolution test with a lateral grid interval of 1.0 degree. This figure shows the same results as that shown in Fig. 5 of the main text but the results are displayed in a different way: black and red stars denote the grid nodes where the sign of input anomalies is recovered correctly and incorrectly, respectively, and the size of the stars is proportional to the percentage of the recovered anomaly relative to that in the input model.

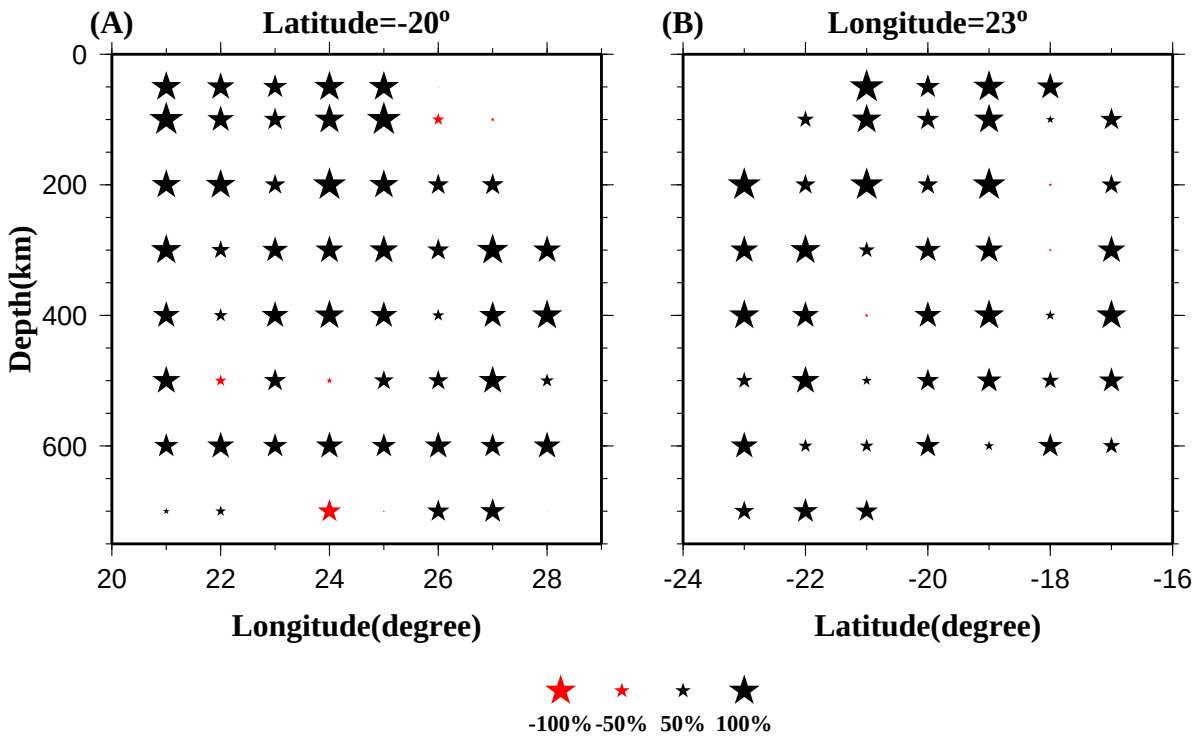

Figure S4. Vertical cross-sections showing the results of a checkerboard resolution test with a lateral grid interval of 1.0 degree along (A) 20 degree south latitude and (B) 23 degree east longitude. Black and red stars denote the grid nodes where the sign of input anomalies is recovered correctly and incorrectly, respectively.

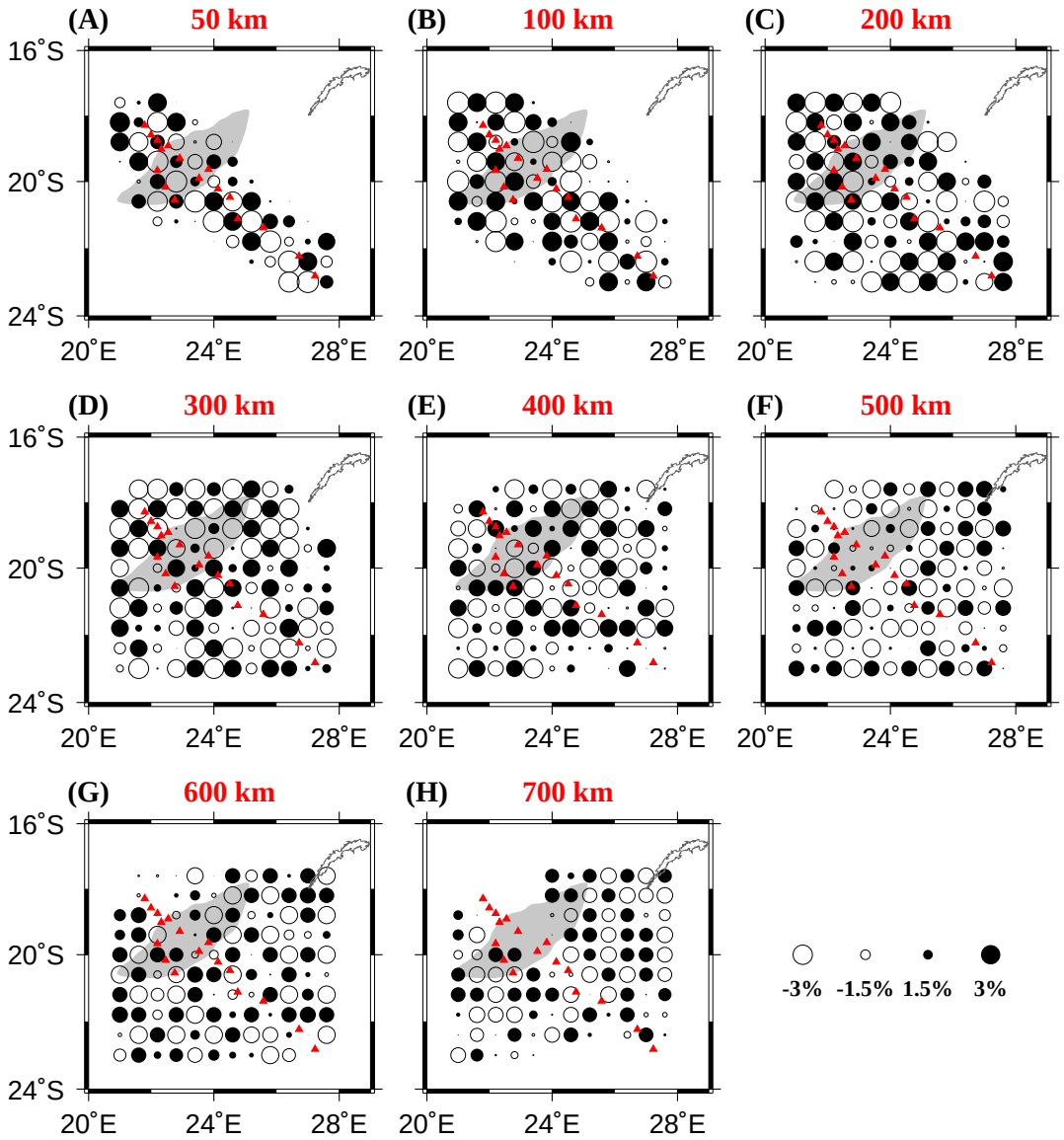

Figure S5. Results of a checkerboard resolution test with a lateral grid interval of 0.6 degrees. The red triangles represent the seismic stations. The gray fan-shaped area indicates the Okavango rift zone. The open and solid circles indicate slow and fast velocity anomalies, respectively, whose scale is shown below (F).

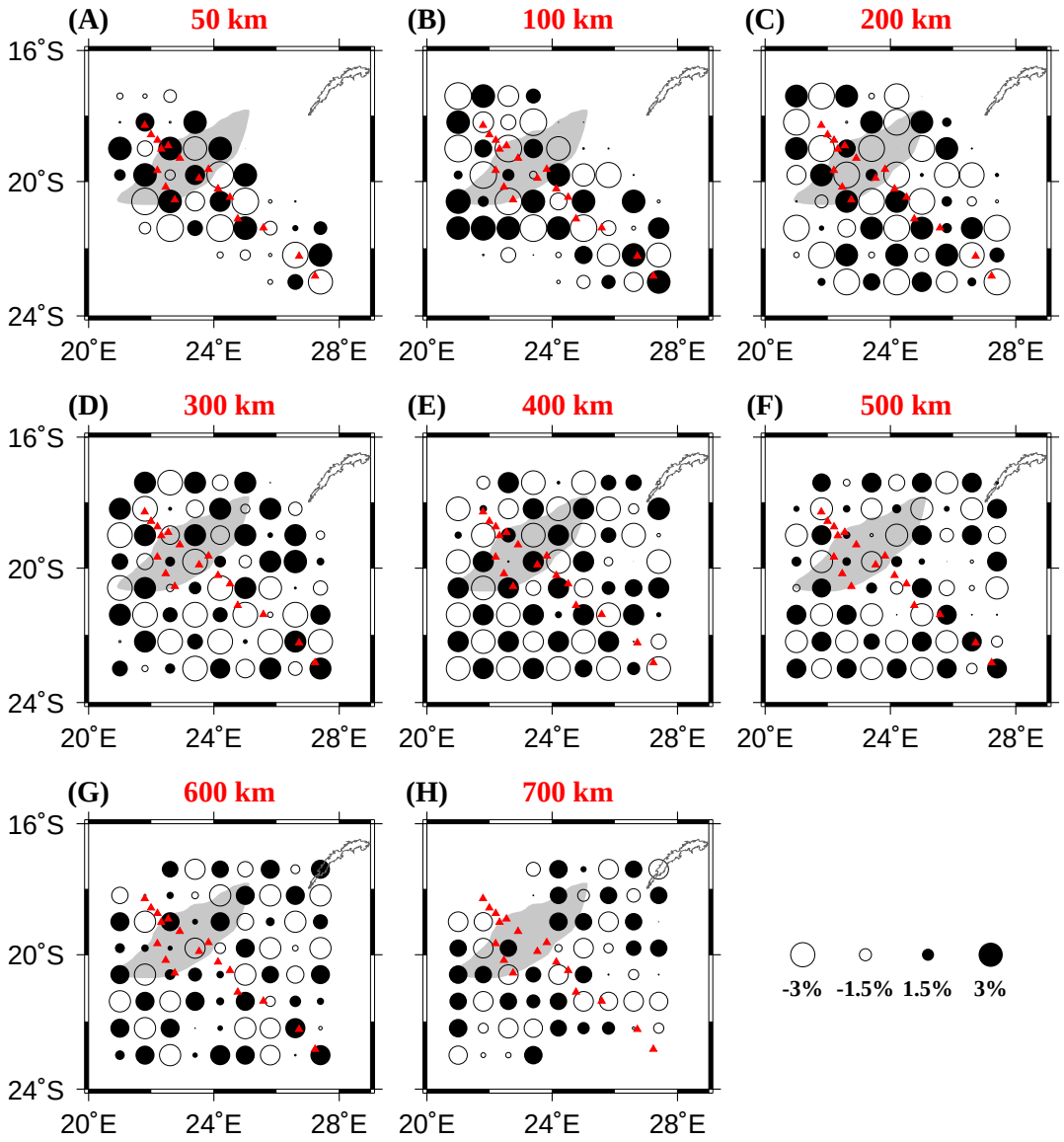

Figure S6. The same as Fig. S5 but with a lateral grid interval of 0.8 degrees.

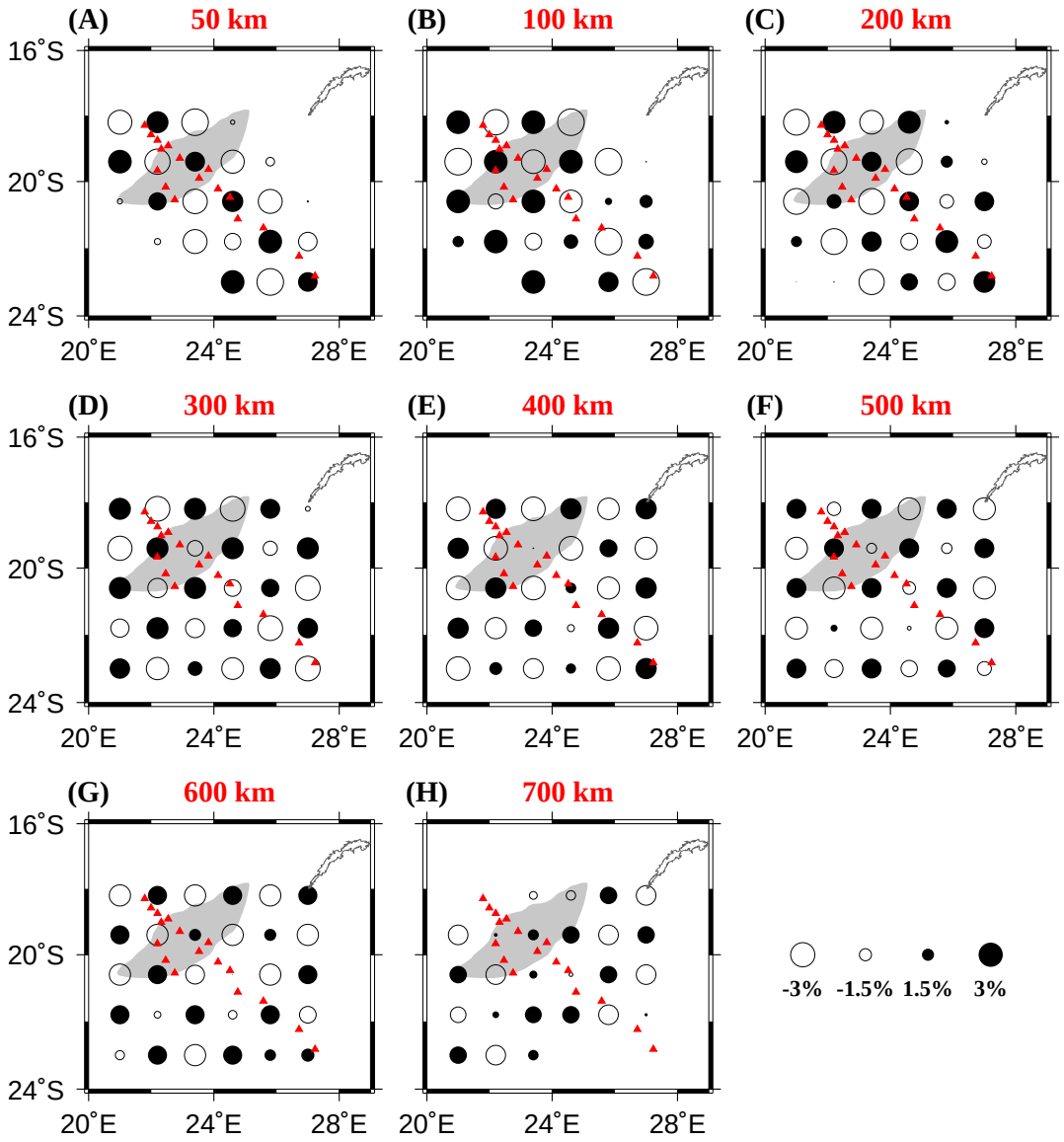

Figure S7. The same as Fig. S5 but with a lateral grid interval of 1.2 degrees.

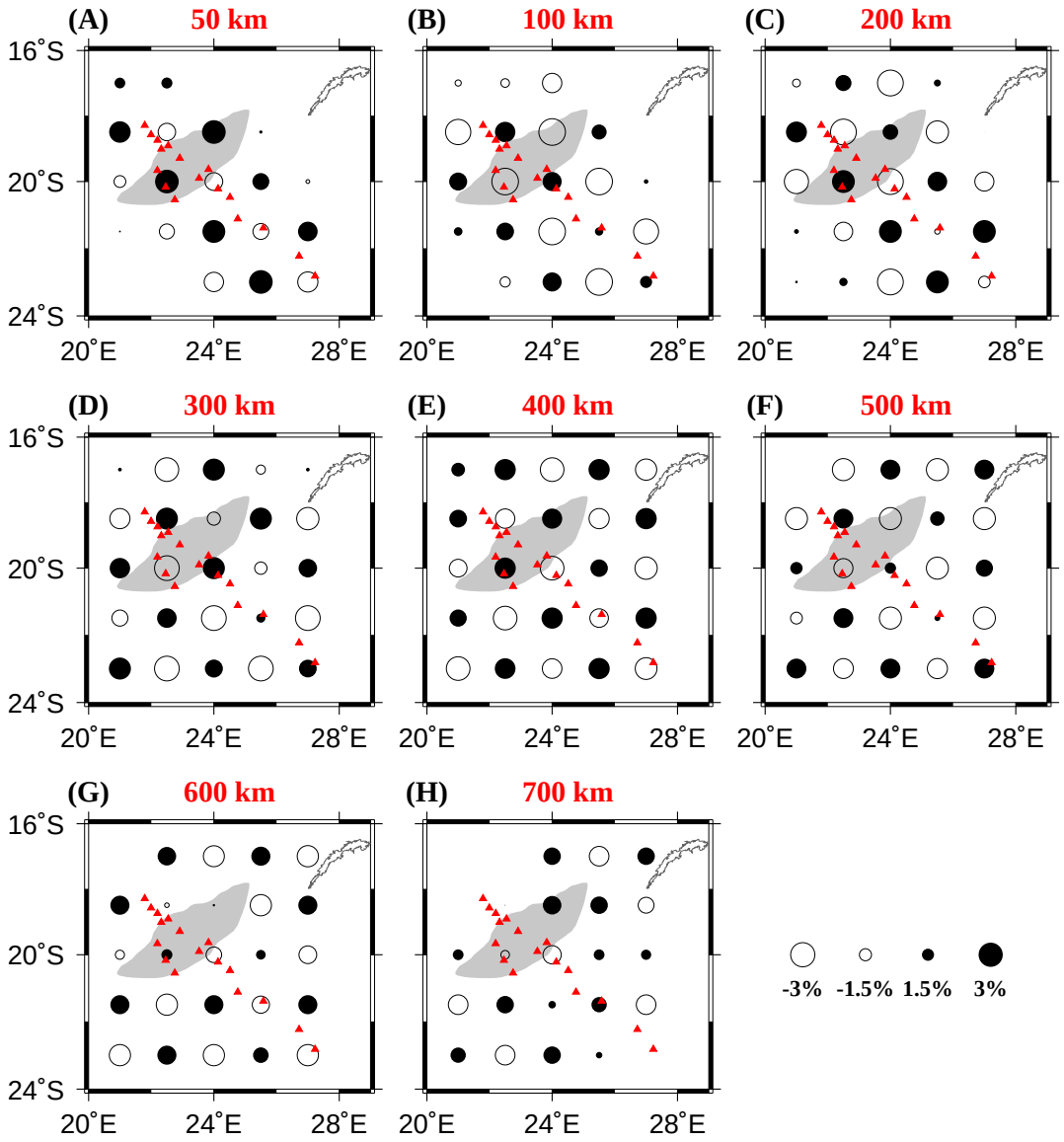

Figure S8. The same as Fig. S5 but with a lateral grid interval of 1.5 degrees.

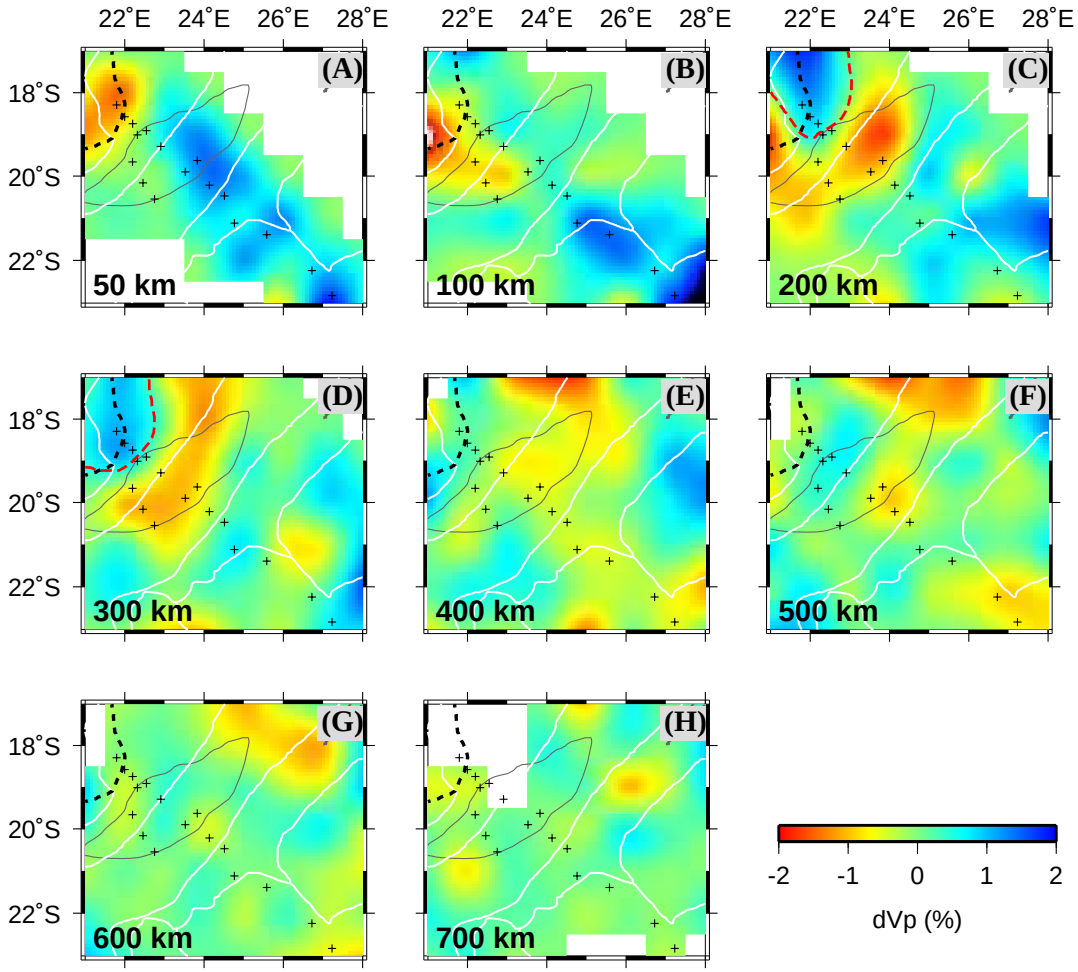

Figure S9. Map views showing the results of the restoration resolution test (see text for details). The red and blue colors denote slow and fast velocities, respectively. The crosses denote the seismic stations. The black dashed line in the NW corner of each map is the southern boundary of the Congo Craton proposed by Singletary et al. (2003), and the red dashed line in (C) and (D) is the revised boundary based on the present results.

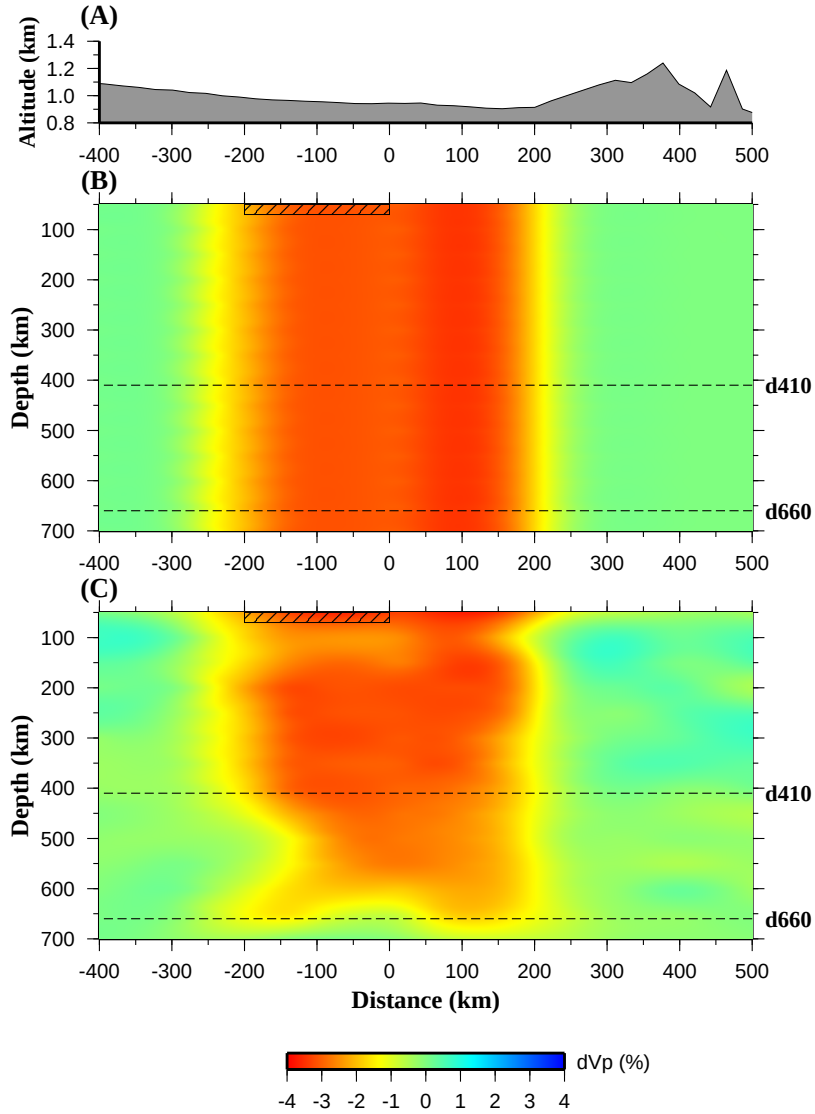

Figure S10. A synthetic test. (A) Surface topography, (B) input model and (C) inverted result along the profile shown in Fig. 1. The red and blue colors indicate slow and fast velocities, respectively. The velocity perturbation scale is shown at the bottom.

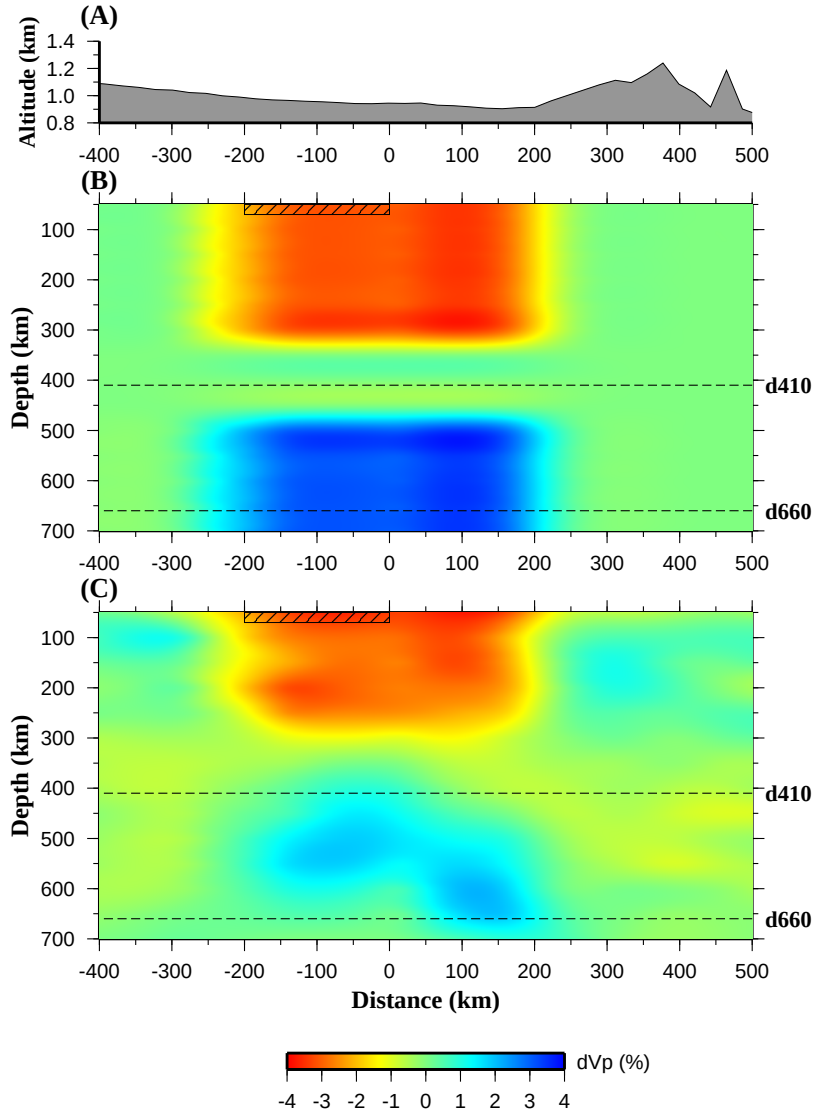

Figure S11. The same as Fig. S10 but for a different input model.

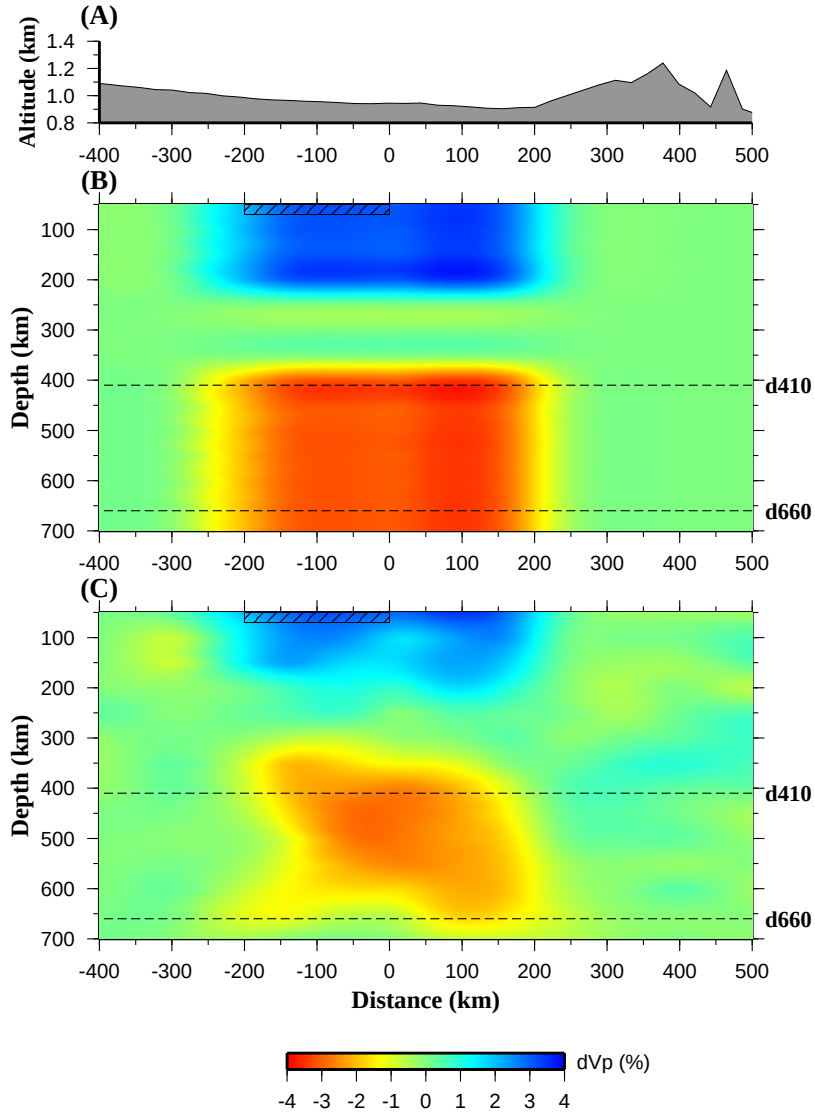

Figure S12. The same as Fig. S10 but for a different input model.