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Supporting Information for

TX2019slab: A New P and S Tomography Model Incorporating Subducting Slabs

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Introduction

This supplementary information contains a hit counts map for the S wave data we used, the P wave craton model used for raypath correction and an illustration of the change in raypath caused by the craton, the effect of the weighting term to connect P and S wave models on variance reduction of seismic data, a cross-section showing relocated earthquakes within a South America slab, comparisons of input slab models and derived tomography results, and a figure that shows the effect of the weighting parameter we used to connect the S and P models in the inversion on the S to P heterogeneity ratios.

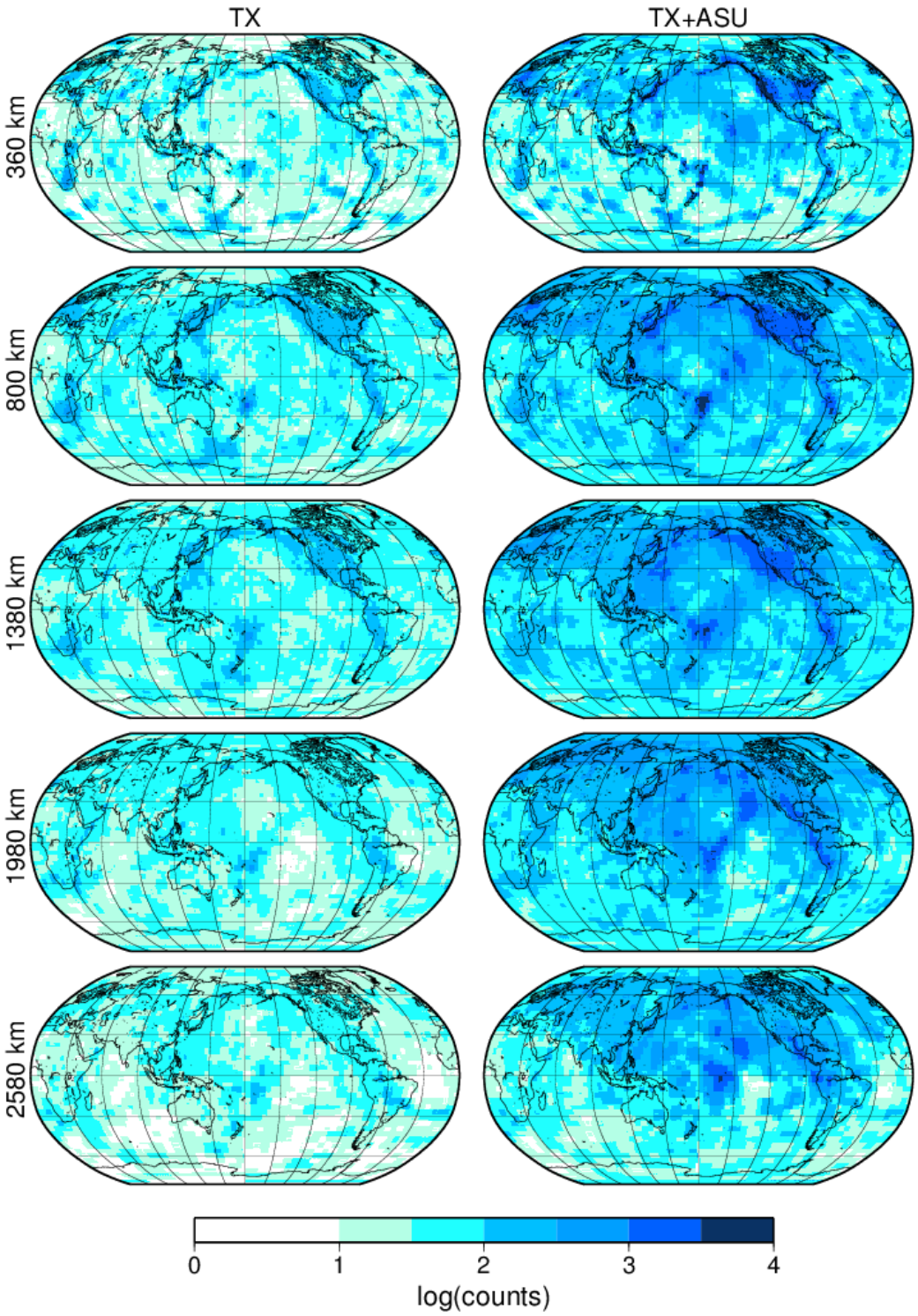

Figure S1. Comparison of hit counts maps for S wave data used in TX2016 model (Lu & Grand, 2016) and this study at selected depths. By adding new data (Lai et al., 2019), S wave data used in this study (right column) have significantly better coverage than in TX2016 (left column). The plots are in logarithm scale.

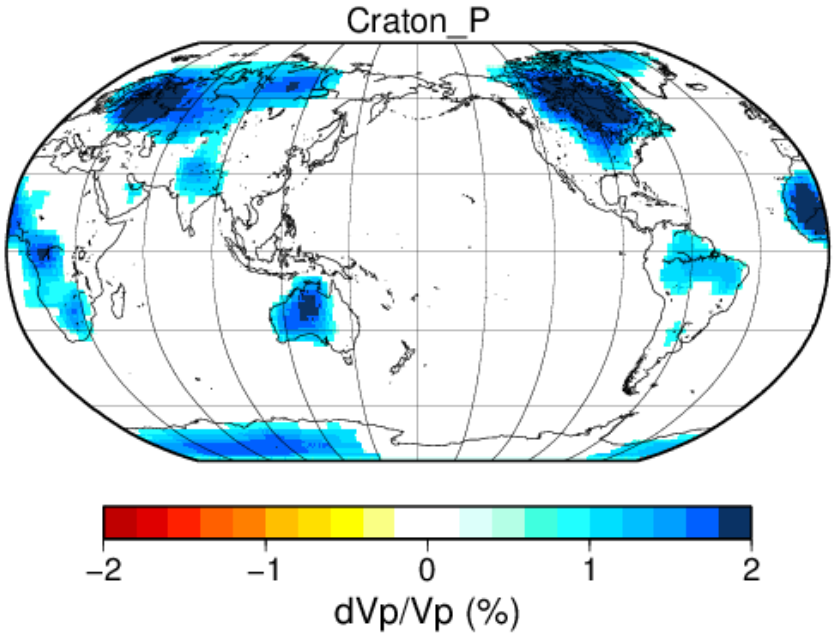

Figure S2. The P wave craton model at 140 km depth that we used for raytracing upper mantle P waves.

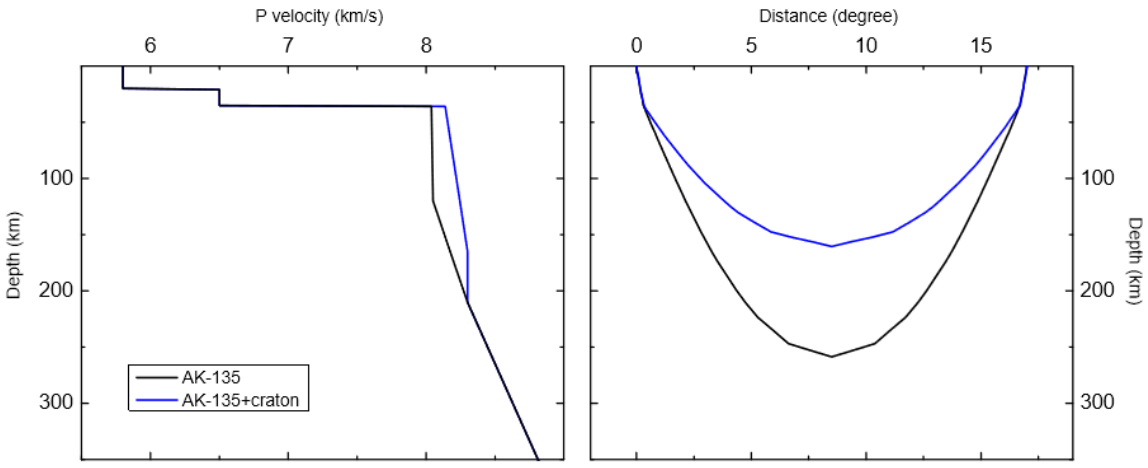

Figure S3. Illustration of the change of a P wave ray path caused by a fast velocity craton. Black lines are the AK-135 model (left) (Kennett et al., 1995) and corresponding P ray path for a surface source recorded at a station 17 degrees away (right). The blue lines are a representative craton model (left) and corresponding ray path for the same source-station pair (right).

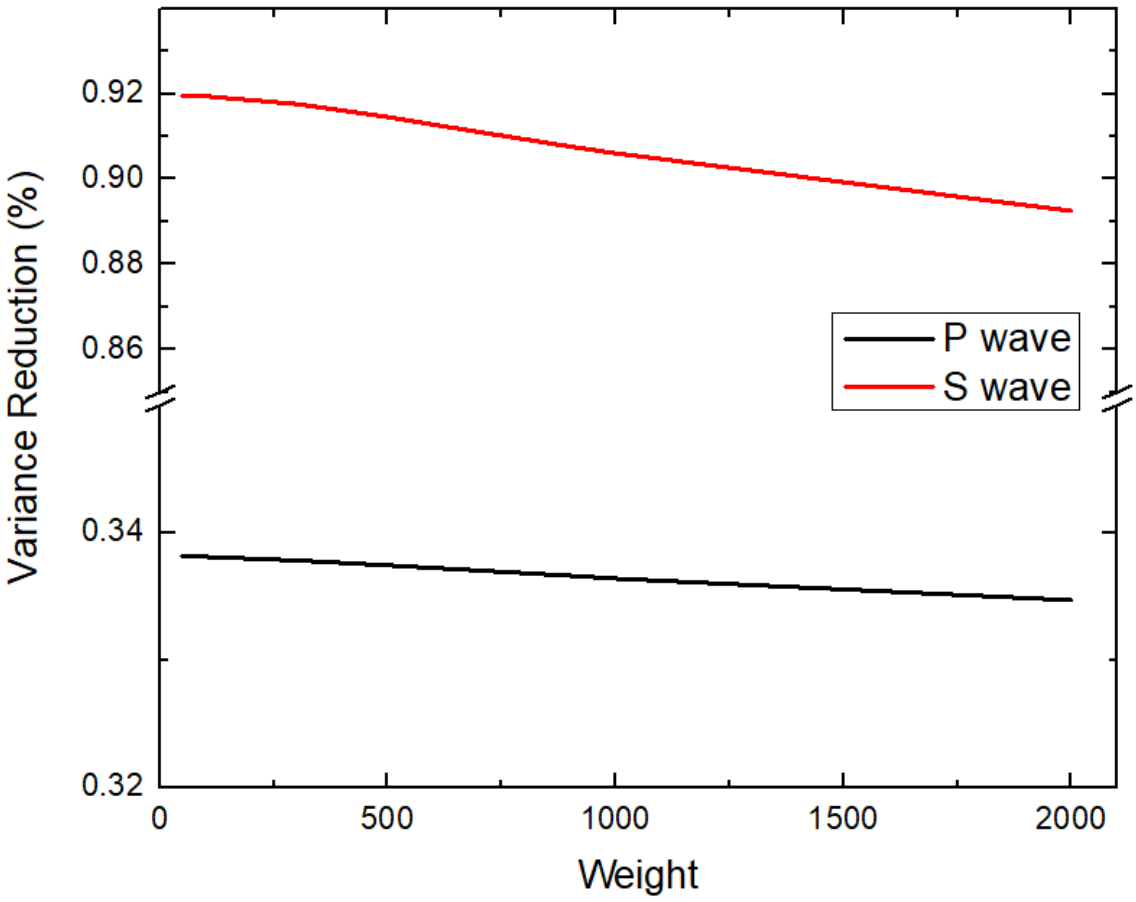

Figure S4. Effect of the weighting term λx used to control how strong the connection between the P and S models is on variance reduction of P and S wave data. λx was chosen to be 500 as our optimal value because it is the highest value before the variance reduction change of the S wave data becomes significant (more than 0.5%).

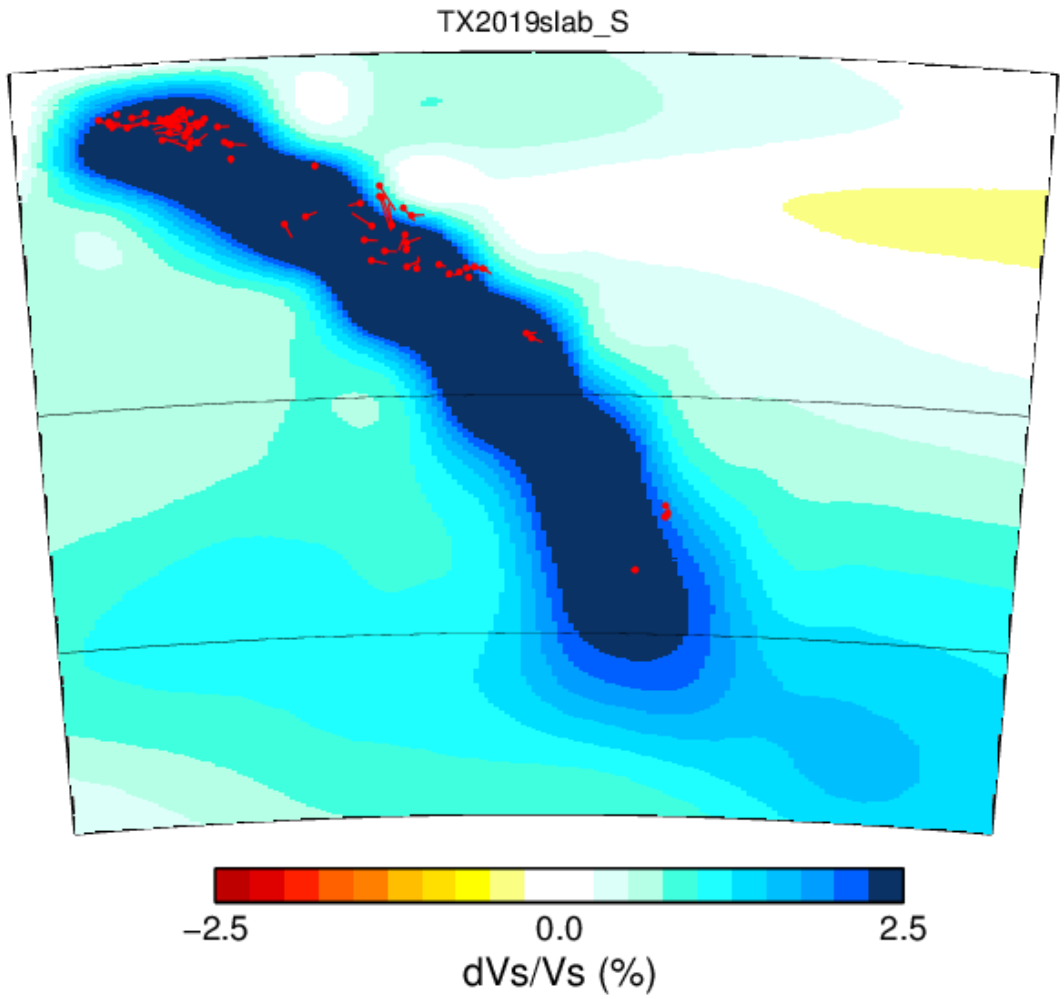

Figure S5. Cross-section showing relocated earthquakes in South America on top of the TX2019slab S wave model. Red dots show the original earthquake locations and red lines point to earthquake locations after relocation. The cross-section is along a great circle from 21°S, 58°W to 21°S, 70°W. Earthquakes are taken from ~100 kms on either side of the cross section.

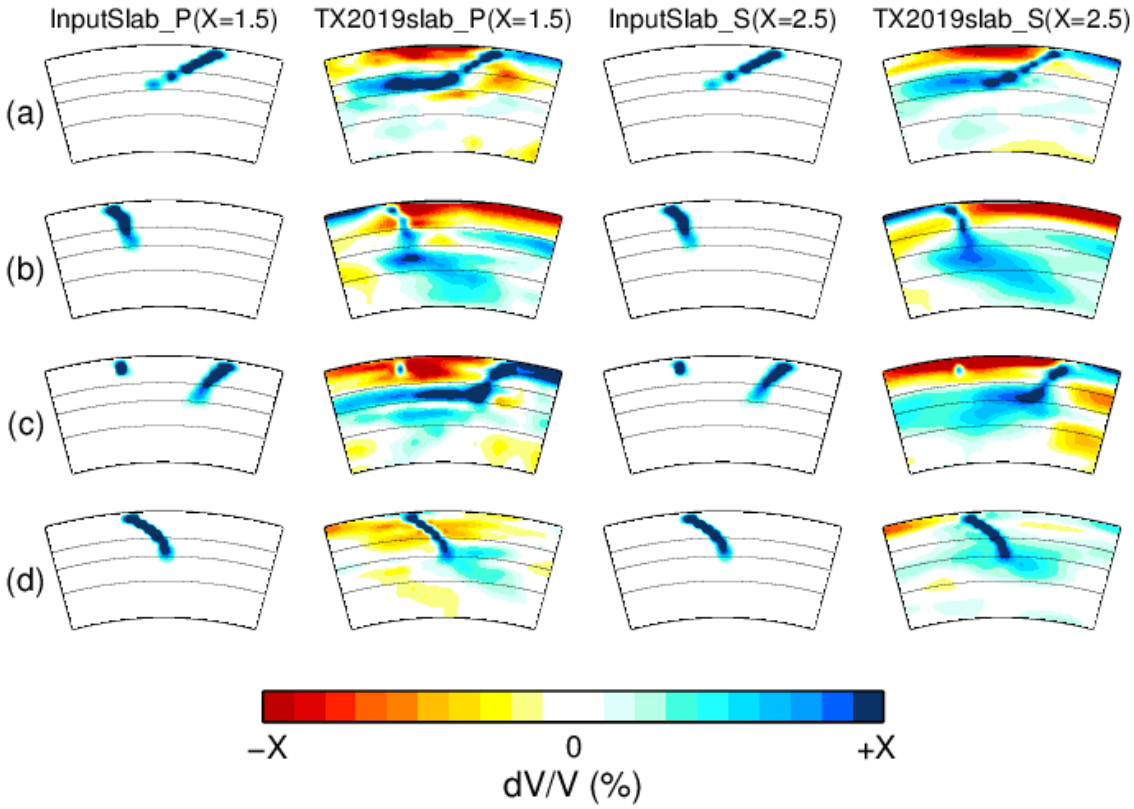

Figure S6. Cross-sections across four major subduction zones comparing the starting slab models used in this study (column 1 and 3) and the final TX2019slab model (column 2 and 4). Each row corresponds to cross-section locations indicated in Figure 4. Solid black lines show 410, 660, and 1000 km depth, respectively.

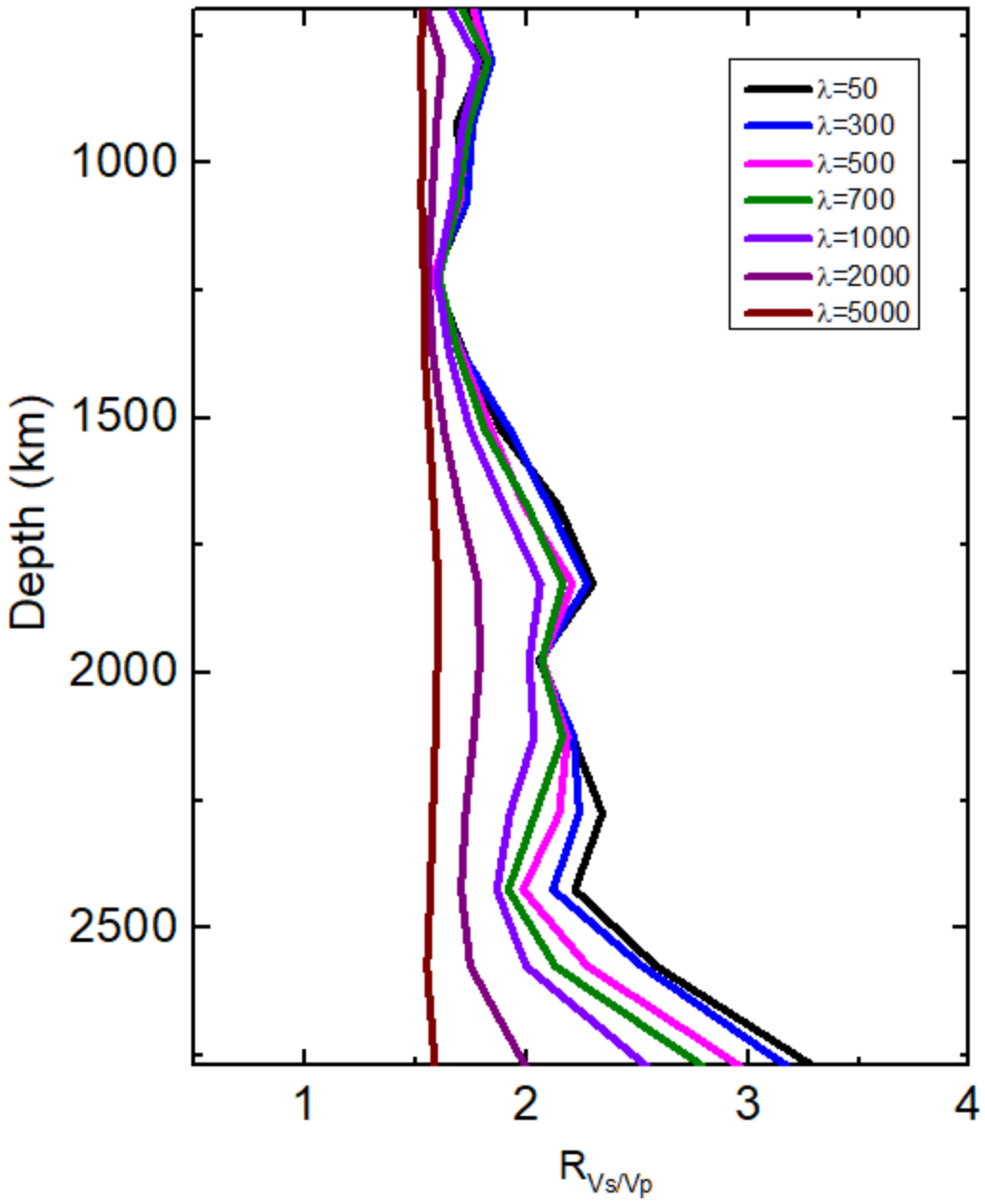

Figure S7. S to P heterogeneity ratio in the lower mantle using point to point method (see main text) with different weights (λ_X) for $X_{P/S}$ in the inversion. We used 500 as our preferred value because it decreases the variance reduction of the S wave data within an acceptable range (less than 0.5%) but still partially constrains the P and S model where data is lacking.