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Supporting Information for

**Likely *PKS-PKP* from Array Processing of Noise Records**

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**Contents of this file**

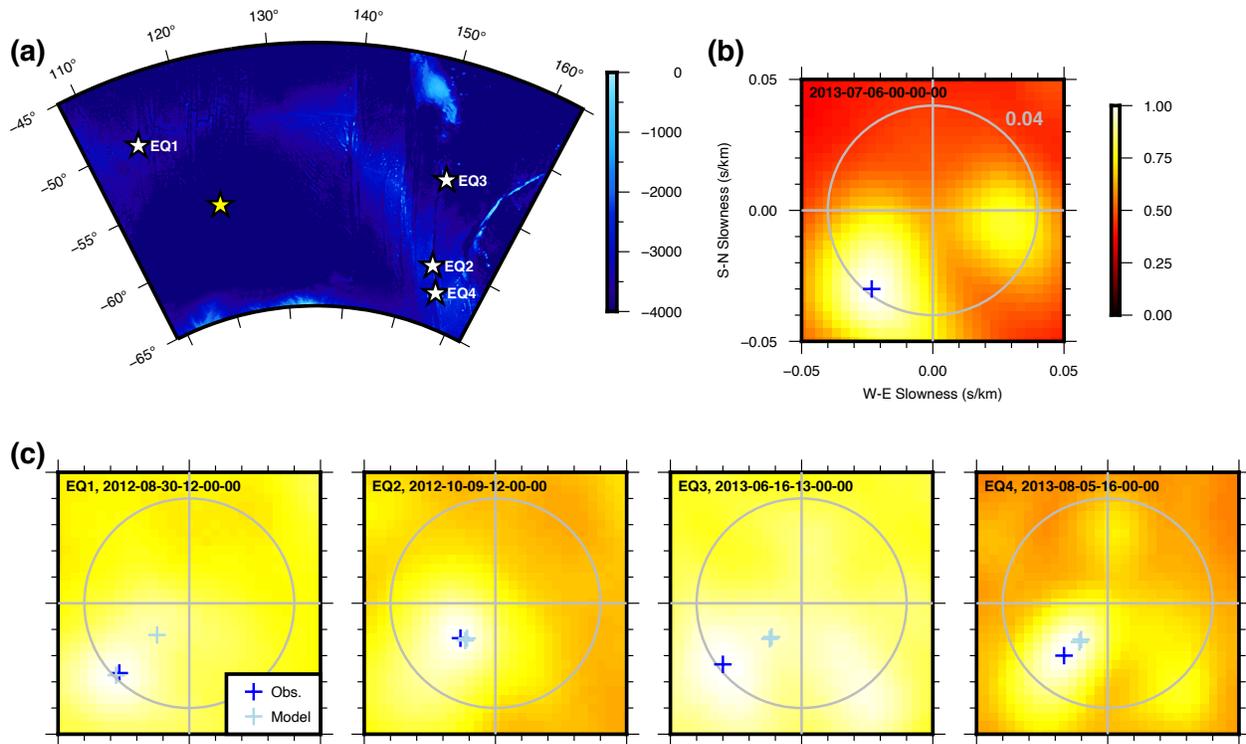
- Supplementary Text 1
- Figures S1–3

**Introduction**

This supplementary information contains Supplementary Text 1 describing the method of our shear-wave splitting analysis. It also contains Supplementary Figures 1–3 and their captions.

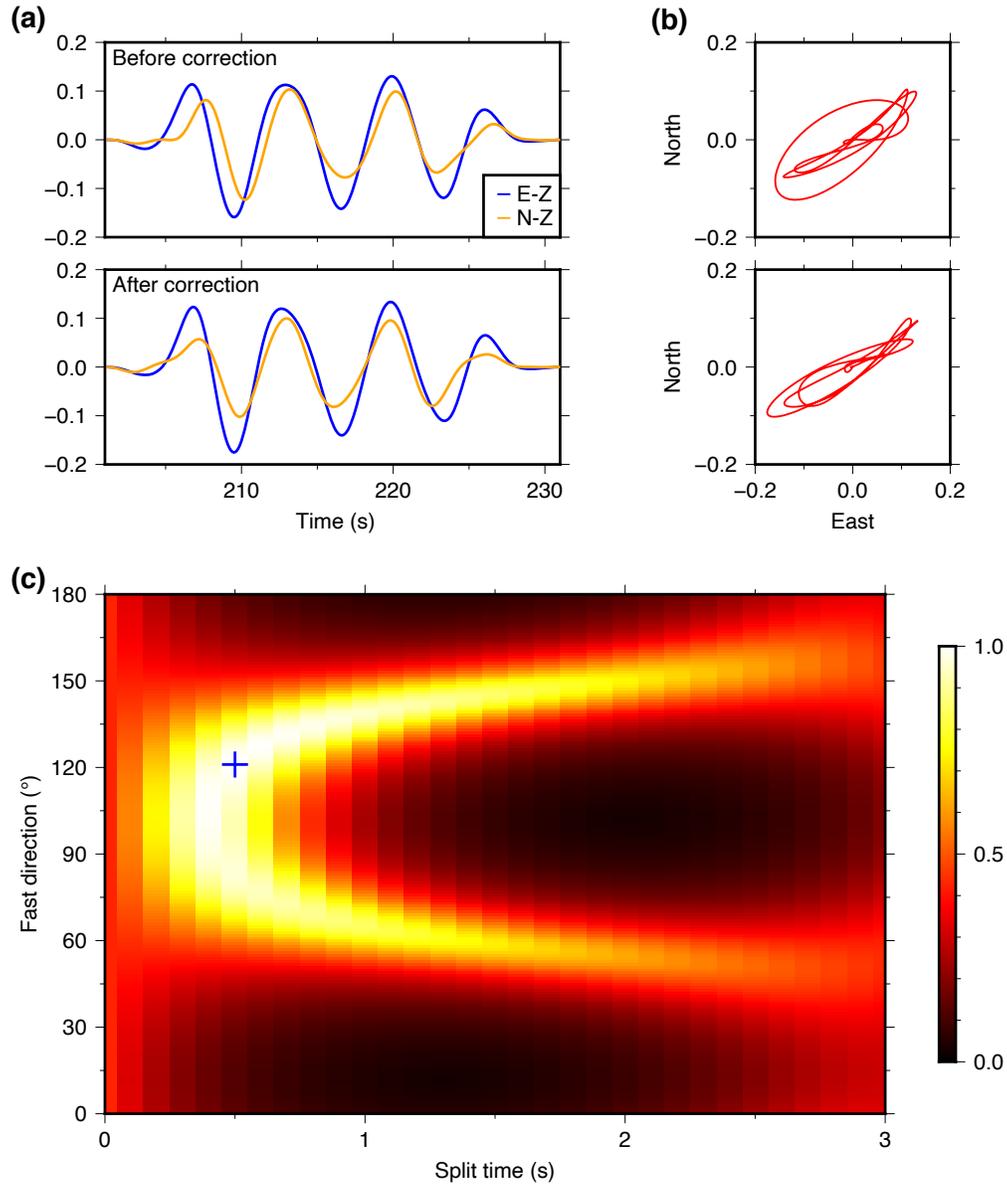
## Supplementary Text 1

We used the covariance-matrix method (Shearer 2019) to derive the fast direction and split time from our *PKS-PKP* observations. For each combination of fast direction and split time, we project the observed east- and north-component *PKS-PKP* records onto the fast and slow axes. We then correct for the split time by delaying the fast component by the split time. We finally compute the waveform covariance matrix with the corrected fast- and slow-component records and derive its two eigenvalues  $\lambda_1$  and  $\lambda_2$ , with  $\lambda_1 > \lambda_2$ . A larger ratio between  $\lambda_1$  and  $\lambda_2$  indicates a particle motion closer to linear. We thus compute the eigenvalue ratios for grid points with fast direction in  $0\text{--}180^\circ$  and split time in  $0\text{--}3$  s and find the combination that maximizes the ratio which gives the optimum fast direction and split time (Fig. S2c and S3c).



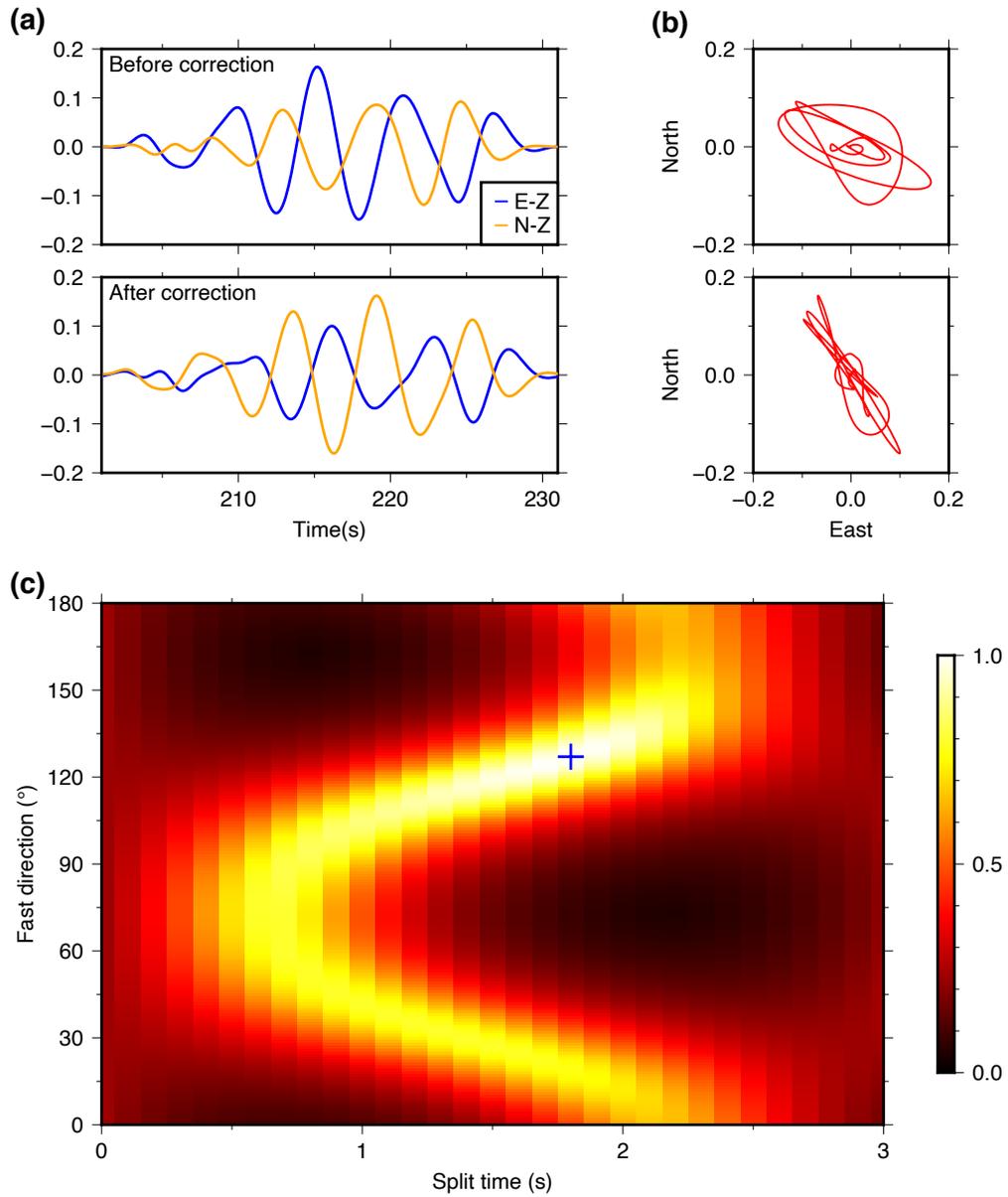
**Figure S1.** Using earthquakes with known locations to evaluate biases in our beamforming. (a) Locations of Earthquake (EQ) 1–4 used for calibration (white stars) and the derived PKP-source location of time window 2013-07-06-00-00-00 (yellow star). (b) Slowness image of the time window 2013-07-06-00-00-00 with the maximum marked with a dark blue cross. The gray circle denotes the slowness of 0.04 s.km<sup>-1</sup>. (c) Same as (b), but for EQ 1–4. The light blue crosses mark the slowness vectors predicted with IASP91 (multiple slownesses are due to different PKP branches).

## PKPbin01



**Figure S2.** Shear-wave-splitting results for the source bin PKP01. (a) E- and N-component PKS-PKP waveforms before (top) and after correction (bottom) using the optimum fast direction and split time. (b) PKS-PKP Particle motions before (top) and after (bottom) the correction. (c) The eigenvalue ratio of the waveform covariance matrix as a function of fast direction and split time. The blue cross marks the maximum, which gives the optimum fast direction and split time.

### PKPbin05



**Figure S3.** Same as Fig. S2, but for the source bin PKP05.

## **Bibliography**

Shearer, P. M. (2019). Shear-Wave Splitting. In P. M. Shearer, *Introduction to Seismology, Third Edition* (pp. 349–358). Cambridge: Cambridge University Press.