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Supporting Information for

# *S*-coda and Rayleigh waves from a decade of repeating earthquakes reveal discordant temporal velocity changes since the 2004 Sumatra Earthquake

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## Introduction

This supporting material includes an assessment of the relative locations within a repeating earthquake (RE) sequence (Text S1, Fig. S1, and Table S2), the Global Positioning System (GPS) post-seismic displacement time series recorded at stations UMLH and LEWK (Figs. S2 and S3), and the source information for the major Sumatra earthquakes, along with the peak ground velocity (PGV) recorded by station PSI, that are discussed in this study (Tables S1 and S3).

## Text S1. Assessment of the relative locations within a RE sequence

The procedure for detecting RE and determining the relative event locations within a RE sequence has been discussed in detail in previous studies [*Wen*, 2006; *Yu*, 2013; *Yu et al.*, 2013]. Here we incorporate smaller events with a body wave magnitude (mb) as low as 4.3. We determine the precise relative relocations within each RE sequence to minimize the potential bias due to the effects of the inter-event distances on the temporal velocity changes. Our relocation results suggest that the inter-event separations are mostly <300 m. We also estimate the location (*uh*) and depth uncertainties (*uz*). Eighty percent of the travel time residuals of the seismic phases are randomly selected (bootstrap resampling) to compute the hypocenters of the target events. *uh* and *uz* are estimated from the major axis of the 95% confidence ellipse, which is computed from 200 bootstrap resamplings. The larger *uh* and *uz* uncertainties are mostly associated with smaller events since the seismographs that can record small events with a sufficient signal strength are mainly concentrated in China, Kyrgyzstan, and Kazakhstan to the north (Table S2). We estimate the rupture areas of individual earthquake, and superimpose the rupture areas on the precise hypocenter relocations. The selected RE sequences show considerable overlap within each sequence, and all satisfy the condition that the ratio of the inter-event separation to the circular rupture area is <0.2 [*Peng and Ben-Zion*, 2006] (Fig. S1).

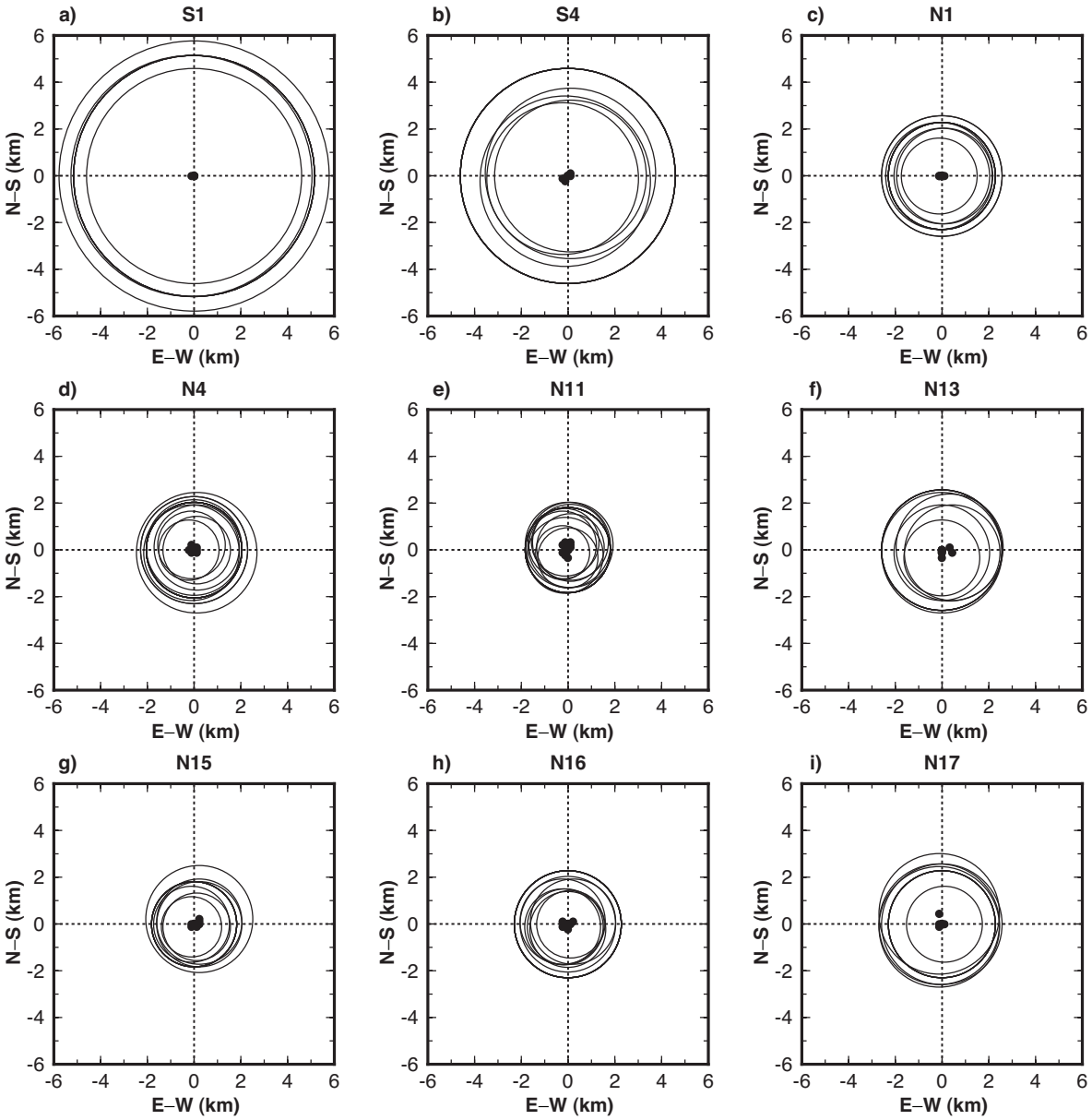


**Figure S1.** Estimated circular rupture zones relative to the precise relative relocations among nine selected repeating earthquake (RE) sequences: (a) S1, (b) S4, (c) N1, (d) N4, (e) N11, (f) N13, (g) N15, (h) N16, and (i) N17, displayed in plane view (E–W and N–S directions). The reference event for each sequence is placed at the origin. The depth differences within each sequence are small (Table S2), such that only the horizontal plane view is displayed.

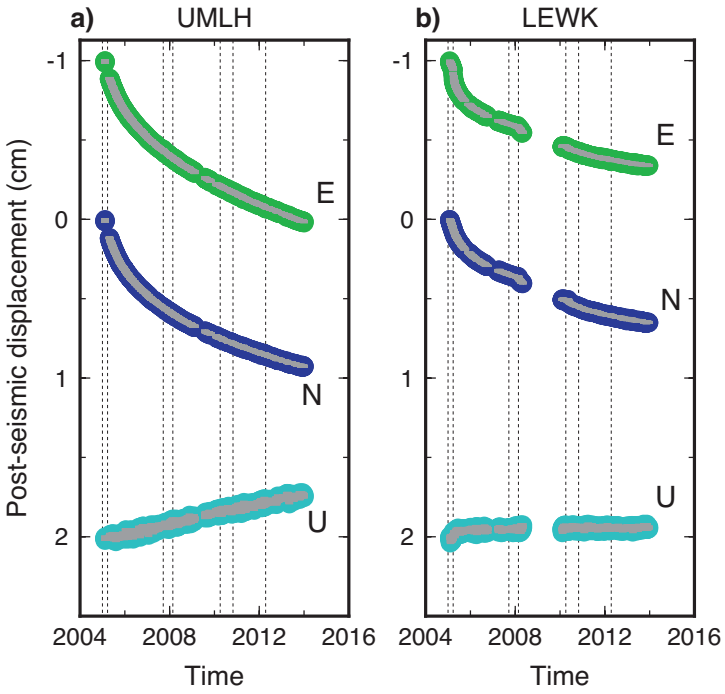


**Figure S2.** Global Positioning System (GPS) post-seismic displacement time series recorded during the 2005–2013 time period at two stations: (a) UMLH and (b) LEWK. The GPS data are processed following *Feng et al.* [2015]. The East–West (E), North–South (N), and vertical (U) components are indicated in green, blue, and light blue, respectively, and the initial values for the E, N, and U components are positioned at −1, 0, and 2 cm, respectively. The standard deviations are indicated by the gray error bars. The vertical dotted lines correspond to the origin times of the 2004, 2005, 2007, 2008, and 2010 Banyak, 2010 Mentawai, and 2012 earthquakes (event information listed in Table S1). The UMLH displacement time series in (a) mainly reflects the post-seismic deformation of the 2004 Sumatra Earthquake, whereas the LEWK displacement time series in (b) reflects the post-seismic deformation from the 2004, 2005, 2008, and 2010 Banyak earthquakes. The UMLH and LEWK station locations are shown in Figure 1.

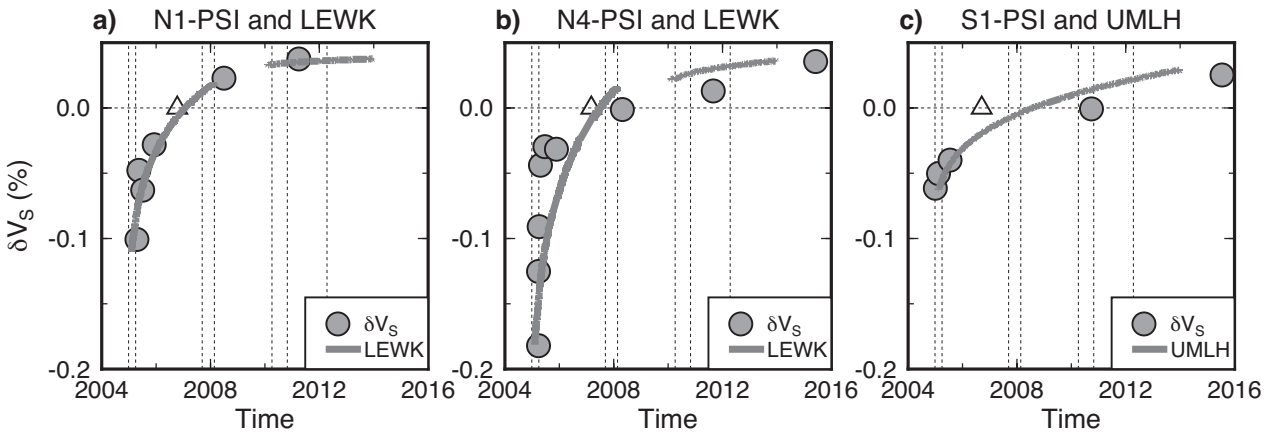


**Figure S3.** Comparison of the temporal $\delta V_S$ changes and normalized GPS post-seismic displacement time series during the 2005–2015 time period. (a) $\delta V_S$ along the N1–PSI path (gray circles) and GPS displacement at station LEWK (gray line). (b) $\delta V_S$ along the N4–PSI path and GPS displacement at station LEWK. (c) $\delta V_S$ along the S1–PSI path and GPS displacement at station UMLH. The presented GPS time series are adapted from the North–South (N) component and scaled to match the observed range of $\delta V_S$ values to facilitate visual comparison. The location of each GPS station and RE sequence is shown in Figure 1.

**Table S1.** Event IDs and source parameters of the major earthquakes near Sumatra and in the Wharton Basin that are discussed in this study.

| Event ID | $M_W$ of co-seismic slip | Region | Event origin date and origin time (UTC) | Latitude (°N) | Longitude (°E) | Depth (km) |
|---|---|---|---|---|---|---|
| 2004 | 9.2 | Sumatra | 2004-12-26 00:58:53 | 3.295 | 95.982 | 30.0 |
| 2005 | 8.6 | Nias Island | 2005-03-28 16:09.36 | 2.085 | 97.108 | 30.0 |
| 2007 | 8.4 | Bengkulu | 2007-09-12 11:10:26 | –4.438 | 101.367 | 34.0 |
| 2007 | 7.9 | Bengkulu | 2007-09-12 23:49:03 | –2.625 | 100.841 | 35.0 |
| 2008 | 7.3 | Simeulue Island | 2008-02-20 08:08:30 | 2.768 | 95.964 | 26.0 |
| 2010 Banyak | 7.8 | Banyak Island | 2010-04-06 22:15:01 | 2.383 | 97.048 | 31.0 |
| 2010 Mentawai | 7.8 | Mentawai Islands | 2010-10-25 14:42:22 | –3.487 | 100.082 | 20.1 |
| 2012 | 8.6 | Wharton Basin | 2012-04-11 08:38:36 | 2.327 | 93.063 | 20.0 |
| 2012 | 8.2 | Wharton Basin | 2012-04-11 10:43:10 | 0.802 | 92.463 | 25.1 |

**Table S2.** Repeating earthquake sequences associated with the 2004 Sumatra and 2005 Nias earthquakes.

| Origin date | Origin time | Latitude (°N) | Longitude (°E) | Depth (km) | *mb* | *dh* (km) | *dz* (km) | *uh* (km) | *uz* (km) | *dT* (years) |
|---|---|---|---|---|---|---|---|---|---|---|
| S1 | | | | | | | | | | |
| **2006-09-16** | 06:17:46.88 | 5.124 | 94.779 | 49.0 | 5.6 | – | – | – | – | – |
| 2004-12-31 | 14:38:46.23 | 5.124 | 94.778 | 48.9 | 5.6 | 0.11 | −0.10 | 0.22 | 0.55 | −1.71 |
| 2005-02-13 | 01:22:08.85 | 5.124 | 94.779 | 49.0 | 5.7 | 0.00 | 0.00 | 0.21 | 0.61 | −1.59 |
| 2005-07-23 | 22:53:34.72 | 5.124 | 94.779 | 49.0 | 5.6 | 0.00 | 0.00 | 0.18 | 0.37 | −1.15 |
| 2010-09-30 | 09:54:10.31 | 5.124 | 94.779 | 49.0 | 5.5 | 0.00 | 0.00 | 0.13 | 0.19 | 4.04 |
| 2015-07-22 | 05:35:36.38 | 5.124 | 94.779 | 49.1 | 5.6 | 0.00 | 0.10 | 0.16 | 0.34 | 8.85 |
| S3 | | | | | | | | | | |
| **2007-06-24** | 13:47:36.58 | 5.423 | 94.585 | 30.0 | 5.1 | – | – | – | – | – |
| 2005-03-12 | 22:33:17.87 | 5.423 | 94.584 | 29.9 | 5.2 | 0.11 | −0.10 | 0.17 | 0.25 | −2.28 |
| 2005-05-31 | 07:28:07.71 | 5.423 | 94.585 | 30.0 | 5.0 | 0.00 | 0.00 | 0.18 | 0.23 | −2.07 |
| 2005-09-07 | 06:42:58.57 | 5.423 | 94.585 | 29.9 | 4.9 | 0.00 | −0.10 | 0.23 | 0.32 | −1.79 |
| 2008-05-08 | 11:31:23.84 | 5.423 | 94.585 | 30.0 | 5.0 | 0.00 | 0.00 | 0.10 | 0.16 | 0.87 |
| 2012-03-31 | 12:38:44.72 | 5.423 | 94.585 | 30.1 | 4.9 | 0.00 | 0.10 | 0.16 | 0.18 | 4.77 |
| 2014-08-04 | 10:36:13.57 | 5.422 | 94.584 | 29.9 | 5.3 | 0.16 | −0.10 | 0.32 | 0.30 | 7.11 |
| S4 | | | | | | | | | | |
| **2006-12-09** | 09:24:46.75 | 5.080 | 94.752 | 54.0 | 5.5 | – | – | – | – | – |
| 2004-12-31 | 10:58:18.27 | 5.081 | 94.753 | 54.0 | 5.4 | 0.16 | 0.00 | 0.14 | 0.55 | −1.94 |
| 2005-05-09 | 01:30:52.27 | 5.080 | 94.752 | 54.0 | 5.5 | 0.00 | 0.00 | 0.13 | 0.20 | −1.59 |
| 2005-09-01 | 16:42:39.13 | 5.081 | 94.753 | 54.1 | 5.3 | 0.16 | 0.10 | 0.16 | 0.28 | −1.27 |
| 2008-03-05 | 17:04:09.94 | 5.078 | 94.751 | 54.1 | 5.3 | 0.25 | 0.10 | 0.38 | 0.54 | 1.24 |
| 2010-09-29 | 11:33:34.59 | 5.079 | 94.750 | 53.9 | 5.2 | 0.25 | −0.10 | 0.20 | 0.31 | 3.81 |
| 2012-08-19 | 01:57:04.27 | 5.080 | 94.753 | 54.2 | 5.2 | 0.11 | 0.20 | 0.16 | 0.19 | 5.69 |
| N1 | | | | | | | | | | |
| **2006-10-09** | 13:45:13.31 | 1.108 | 97.107 | 23.0 | 4.9 | – | – | – | – | – |
| 2005-04-15 | 21:32:31.17 | 1.108 | 97.107 | 23.2 | 5.0 | 0.00 | 0.20 | 0.40 | 0.91 | −1.48 |
| 2005-05-12 | 02:29:21.09 | 1.108 | 97.107 | 23.1 | 4.8 | 0.00 | 0.10 | 0.26 | 0.53 | −1.41 |
| 2005-07-06 | 22:41:58.81 | 1.108 | 97.108 | 23.0 | 4.8 | 0.11 | 0.00 | 0.32 | 0.57 | −1.26 |
| 2005-12-03 | 18:48:08.71 | 1.108 | 97.107 | 23.0 | 5.0 | 0.00 | 0.00 | 0.21 | 0.40 | −0.85 |
| 2008-07-02 | 14:55:09.79 | 1.108 | 97.106 | 22.9 | 4.9 | 0.11 | −0.10 | 0.22 | 0.45 | 1.73 |
| 2011-03-29 | 06:59:41.00 | 1.108 | 97.106 | 23.0 | 4.6 | 0.11 | 0.00 | 0.38 | 0.61 | 4.47 |
| N2 | | | | | | | | | | |
| **2005-10-18** | 11:22:10.99 | 1.399 | 97.145 | 26.0 | 4.6 | – | – | – | – | – |
| 2005-03-29 | 03:44:34.00 | 1.401 | 97.147 | 26.4 | 4.9 | 0.31 | 0.40 | 2.67 | 3.56 | −0.56 |
| 2005-04-03 | 07:28:54.64 | 1.401 | 97.146 | 26.2 | 4.9 | 0.25 | 0.20 | 2.28 | 3.66 | −0.54 |
| 2005-04-28 | 12:54:41.60 | 1.402 | 97.147 | 26.4 | 4.7 | 0.40 | 0.40 | 1.78 | 2.54 | −0.47 |
| 2005-06-05 | 04:49:08.75 | 1.400 | 97.146 | 26.2 | 4.7 | 0.16 | 0.20 | 2.12 | 3.36 | −0.37 |
| 2005-07-28 | 07:11:55.35 | 1.399 | 97.146 | 25.9 | 4.7 | 0.11 | 0.10 | 6.87 | 8.43 | −0.22 |

| Origin date | Origin time | Latitude (°N) | Longitude (°E) | Depth (km) | *mb* | *dh* (km) | *dz* (km) | *uh* (km) | *uz* (km) | *dT* (years) |
|---|---|---|---|---|---|---|---|---|---|---|
| N3 | | | | | | | | | | |
| **2005-07-01** | 16:57:44.92 | 0.929 | 97.417 | 21.0 | 4.6 | – | – | – | – | – |
| 2005-03-28 | 23:20:32.37 | 0.927 | 97.418 | 21.0 | 4.7 | 0.25 | 0.00 | 4.37 | 5.03 | −0.26 |
| 2005-03-29 | 14:43:32.80 | 0.931 | 97.417 | 21.3 | 4.8 | 0.22 | 0.30 | 0.81 | 1.64 | −0.26 |
| 2005-04-03 | 07:15:12.51 | 0.928 | 97.417 | 20.9 | 4.7 | 0.11 | 0.10 | 2.57 | 3.97 | −0.24 |
| 2005-04-10 | 15:25:01.72 | 0.932 | 97.418 | 21.1 | 4.7 | 0.35 | 0.10 | 2.11 | 3.68 | −0.22 |
| 2005-05-15 | 16:31:50.60 | 0.927 | 97.416 | 20.5 | 4.6 | 0.25 | 0.50 | 1.46 | 2.81 | −0.13 |
| N4 | | | | | | | | | | |
| **2007-03-06** | 09:34:03.12 | 1.404 | 97.060 | 30.0 | 4.8 | – | – | – | – | – |
| 2005-03-28 | 18:41:40.64 | 1.403 | 97.059 | 29.9 | 4.8 | 0.16 | −0.10 | 1.38 | 1.31 | −1.94 |
| 2005-03-31 | 19:14:36.64 | 1.404 | 97.060 | 30.0 | 4.9 | 0.00 | 0.00 | 0.75 | 0.87 | −1.93 |
| 2005-04-10 | 09:51:01.06 | 1.403 | 97.061 | 30.1 | 5.0 | 0.16 | 0.10 | 1.68 | 2.76 | −1.90 |
| 2005-04-26 | 15:22:34.05 | 1.405 | 97.060 | 30.3 | 4.8 | 0.11 | 0.30 | 1.65 | 1.59 | −1.86 |
| 2005-06-21 | 04:19:34.17 | 1.405 | 97.061 | 30.1 | 4.7 | 0.16 | 0.10 | 1.12 | 1.34 | −1.71 |
| 2005-11-29 | 09:12:05.18 | 1.404 | 97.060 | 30.0 | 4.9 | 0.00 | 0.00 | 0.90 | 0.98 | −1.27 |
| 2008-05-03 | 10:51:38.57 | 1.404 | 97.058 | 30.0 | 4.4 | 0.22 | 0.00 | 1.99 | 1.78 | 1.16 |
| 2011-09-04 | 22:08:07.50 | 1.404 | 97.061 | 30.0 | 4.5 | 0.11 | 0.00 | 3.07 | 2.56 | 4.50 |
| 2015-06-10 | 12:16:28.95 | 1.406 | 97.059 | 29.9 | 4.5 | 0.25 | −0.10 | 3.78 | 3.70 | 8.26 |
| N9 | | | | | | | | | | |
| **2007-11-26** | 15:18:30.90 | 1.255 | 97.190 | 16.0 | 4.8 | – | – | – | – | 1.93 |
| 2005-03-30 | 02:06:12.27 | 1.256 | 97.193 | 16.3 | 4.8 | 0.35 | 0.30 | 5.07 | 5.89 | −0.73 |
| 2005-04-19 | 03:40:16.79 | 1.257 | 97.193 | 16.4 | 4.7 | 0.40 | 0.40 | 2.66 | 3.79 | −0.68 |
| 2005-12-23 | 11:42:42.34 | 1.255 | 97.190 | 16.1 | 4.6 | 0.00 | 0.10 | 3.05 | 3.84 | – |
| N10 | | | | | | | | | | |
| **2007-02-18** | 12:26:10.91 | 1.233 | 97.048 | 24.0 | 4.8 | – | – | – | – | – |
| 2005-03-29 | 17:42:36.25 | 1.234 | 97.049 | 24.2 | 4.9 | 0.16 | 0.20 | 0.78 | 0.77 | −1.89 |
| 2005-04-04 | 11:05:37.27 | 1.232 | 97.050 | 24.1 | 5.1 | 0.25 | 0.10 | 1.17 | 1.84 | −1.88 |
| 2005-04-17 | 07:48:08.30 | 1.233 | 97.049 | 24.1 | 4.8 | 0.11 | 0.10 | 1.03 | 1.43 | −1.84 |
| 2005-11-12 | 22:38:40.27 | 1.233 | 97.048 | 24.0 | 4.8 | 0.00 | 0.00 | 0.50 | 0.94 | −1.27 |
| N11 | | | | | | | | | | |
| **2007-10-28** | 17:51:30.36 | 1.198 | 97.434 | 35.0 | 4.7 | – | – | – | – | 0.71 |
| 2005-04-03 | 13:40:16.29 | 1.200 | 97.435 | 35.2 | 4.7 | 0.25 | 0.20 | 4.59 | 6.60 | −1.86 |
| 2005-04-10 | 00:55:16.70 | 1.200 | 97.434 | 35.1 | 4.7 | 0.22 | 0.10 | 3.15 | 4.24 | −1.84 |
| 2005-05-30 | 09:02:34.55 | 1.201 | 97.435 | 35.1 | 4.6 | 0.35 | 0.10 | 1.95 | 2.33 | −1.70 |
| 2005-08-02 | 07:15:43.70 | 1.201 | 97.433 | 35.0 | 4.5 | 0.35 | 0.00 | 2.00 | 2.16 | −1.53 |
| 2005-10-19 | 18:47:54.07 | 1.196 | 97.433 | 34.8 | 4.6 | 0.25 | −0.20 | 3.22 | 3.58 | −1.31 |
| 2007-02-10 | 08:10:15.61 | 1.199 | 97.435 | 35.1 | 4.5 | 0.16 | 0.10 | 4.41 | 5.40 | – |
| 2010-09-30 | 21:47:21.69 | 1.197 | 97.432 | 34.9 | 4.3 | 0.25 | −0.10 | 2.56 | 2.93 | 3.64 |
| 2012-06-26 | 17:08:47.35 | 1.195 | 97.434 | 35.1 | 4.4 | 0.33 | 0.10 | 4.20 | 4.47 | 5.37 |
| 2015-09-04 | 08:02:15.02 | 1.200 | 97.432 | 34.8 | 4.5 | 0.31 | −0.20 | 3.54 | 2.48 | 8.56 |

| Origin date | Origin time | Latitude (°N) | Longitude (°E) | Depth (km) | *mb* | *dh* (km) | *dz* (km) | *uh* (km) | *uz* (km) | *dT* (years) |
|---|---|---|---|---|---|---|---|---|---|---|
| N13 | | | | | | | | | | |
| **2007-11-26** | 15:03:42.10 | 1.091 | 97.103 | 35.0 | 5.0 | – | – | – | – | 1.93 |
| 2005-04-19 | 03:31:30.80 | 1.090 | 97.107 | 35.3 | 4.8 | 0.46 | 0.30 | 1.29 | 1.62 | −0.68 |
| 2005-09-08 | 14:41:52.16 | 1.092 | 97.106 | 35.2 | 4.9 | 0.35 | 0.20 | 1.51 | 2.82 | −0.29 |
| 2005-12-23 | 11:25:20.33 | 1.088 | 97.103 | 35.0 | 4.6 | 0.33 | 0.00 | 0.46 | 0.57 | – |
| 2010-03-15 | 18:54:23.17 | 1.090 | 97.103 | 34.9 | 4.8 | 0.11 | −0.10 | 1.30 | 1.64 | 4.22 |
| 2014-06-17 | 16:04:43.10 | 1.090 | 97.103 | 34.9 | 5.0 | 0.11 | −0.10 | 0.27 | 0.30 | 8.48 |
| N15 | | | | | | | | | | |
| **2007-10-26** | 22:45:10.13 | 2.220 | 96.410 | 35.0 | 4.7 | – | – | – | – | 0.58 |
| 2005-04-20 | 00:30:32.47 | 2.222 | 96.412 | 35.1 | 4.9 | 0.31 | 0.10 | 2.34 | 3.60 | −1.94 |
| 2005-06-23 | 08:43:08.24 | 2.220 | 96.412 | 35.1 | 4.7 | 0.22 | 0.10 | 6.58 | 5.70 | −1.76 |
| 2005-10-05 | 00:27:25.77 | 2.219 | 96.411 | 35.1 | 4.5 | 0.16 | 0.10 | 1.81 | 1.72 | −1.48 |
| 2006-09-10 | 18:41:25.85 | 2.221 | 96.412 | 35.1 | 4.7 | 0.25 | 0.10 | 0.33 | 0.42 | −0.55 |
| 2007-03-29 | 01:36:03.38 | 2.219 | 96.409 | 34.8 | 4.4 | 0.16 | −0.20 | 1.93 | 2.22 | – |
| 2013-07-09 | 01:05:38.93 | 2.220 | 96.409 | 34.7 | 4.6 | 0.11 | −0.30 | 0.97 | 0.90 | 6.28 |
| N16 | | | | | | | | | | |
| **2007-07-30** | 06:56:07.30 | 2.195 | 96.231 | 37.4 | 4.9 | – | – | – | – | – |
| 2005-03-29 | 03:38:28.12 | 2.196 | 96.233 | 37.6 | 4.7 | 0.25 | 0.20 | 1.77 | 2.55 | −2.34 |
| 2005-04-03 | 06:55:56.70 | 2.195 | 96.231 | 37.5 | 4.8 | 0.00 | 0.10 | 0.95 | 1.10 | −2.32 |
| 2005-04-25 | 22:58:03.57 | 2.195 | 96.232 | 37.7 | 4.5 | 0.11 | 0.30 | 1.11 | 1.67 | −2.26 |
| 2005-08-23 | 21:52:41.82 | 2.193 | 96.231 | 37.5 | 4.6 | 0.22 | 0.10 | 1.43 | 1.94 | −1.93 |
| 2005-12-12 | 12:36:47.83 | 2.196 | 96.229 | 37.5 | 4.7 | 0.25 | 0.10 | 2.89 | 3.99 | −1.63 |
| 2010-03-18 | 00:04:44.49 | 2.196 | 96.233 | 37.7 | 4.2 | 0.25 | 0.30 | 2.03 | 2.29 | 2.63 |
| 2012-05-30 | 20:12:48.01 | 2.194 | 96.229 | 37.3 | 4.6 | 0.25 | −0.10 | 0.42 | 0.35 | 4.83 |
| 2016-01-04 | 21:09:02.26 | 2.194 | 96.230 | 37.5 | 4.6 | 0.16 | 0.10 | 0.61 | 0.44 | 8.43 |
| N17 | | | | | | | | | | |
| **2010-11-15** | 09:43:25.73 | 1.307 | 97.127 | 39.3 | 4.9 | – | – | – | – | 4.08 |
| 2005-03-28 | 18:13:22.98 | 1.311 | 97.126 | 39.3 | 5.0 | 0.46 | 0.00 | 1.25 | 1.25 | −1.56 |
| 2005-05-25 | 18:47:32.65 | 1.307 | 97.127 | 39.4 | 5.0 | 0.00 | 0.10 | 0.89 | 1.15 | −1.40 |
| 2005-09-19 | 14:34:53.65 | 1.306 | 97.126 | 39.3 | 5.0 | 0.16 | 0.00 | 0.51 | 0.76 | −1.08 |
| 2006-10-18 | 02:01:25.71 | 1.307 | 97.126 | 39.2 | 5.0 | 0.11 | −0.10 | 0.66 | 0.66 | – |
| 2008-02-02 | 03:19:15.97 | 1.307 | 97.128 | 39.2 | 4.6 | 0.11 | −0.10 | 0.86 | 1.61 | 1.29 |

**Caption for Table S2**

Source parameters for selected RE sequences. The bold-faced event origin date is the reference event for each relocation; the origin time and hypocenter of each reference event are fixed to the values in the PDE catalog (https://earthquake.usgs.gov/data/pde.php). The underlined event origin date of each sequence is the reference event used to compute *δV*. The origin time of the target event is

corrected for the origin time error between each event pair, which is inferred from the master event algorithm [*Wen*, 2006]. *mb* is body wave magnitude; *dh* and *dz* are the horizontal and vertical separations between each event pair based on the relocation results, respectively; *uh* and *uz* are the uncertainties in the relative location and depth of an event pair estimated from 200 bootstrap resampling computations, respectively; and *dT* is the time separation between the target events and reference event used for computing $\delta V$.

**Table S3.** Peak ground velocity (PGV) of the large earthquakes near Sumatra and in the Wharton Basin that were recorded by station PSI, and their epicentral distances. Note that the PGV is computed from the geometric mean of the PGV amplitudes of the transverse and radial components that were measured in the 0.5–2.0 Hz frequency range.

| Event ID | $M_W$ | PGV (cm/s) | Epicentral distance (km) |
|---|---|---|---|
| 2004 | 9.2 | $2.45 \times 10^{-1}$ | 333.7 |
| 2005 | 8.6 | $5.01 \times 10^{-1}$ | 212.9 |
| 2007 | 8.4 | $1.15 \times 10^{-1}$ | 834.1 |
| 2007 | 7.9 | $1.11 \times 10^{-1}$ | 625.6 |
| 2008 | 7.3 | $1.09 \times 10^{-1}$ | 329.2 |
| 2010 Banyak | 7.8 | $2.69 \times 10^{-1}$ | 211.4 |
| 2010 Mentawai | 7.8 | $4.00 \times 10^{-3}$ | 695.5 |
| 2012 | 8.6 | $1.18 \times 10^{-1}$ | 653.0 |
| 2012 | 8.2 | $4.34 \times 10^{-2}$ | 748.7 |

**References**

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