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Supporting Information for

Diverse volumetric faulting patterns in the San Jacinto fault zone

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Introduction

This supporting information includes additional details regarding the data used and sensitivity tests of the results. Figure S1 shows the spatial distribution of \(M \geq 5\) events in the San Jacinto Fault Zone. Figure S2 shows the stations used for detection and relocation of each aftershock sequence. Figure S3 shows the temporal variation of seismicity in the trifurcation area since 1937. Figure S4 to S6 show depth-faulting-type distributions calculated using different fault zone widths. Figure S7 shows the nearest-neighbor distance distribution with different cutoff magnitudes. Figure S8 and TableS2 show the location uncertainties of all relocated aftershocks and mainshocks, respectively. Figure S9 compares relocation results using different station distributions. Table S1 is the 1D velocity model used for relocation, which was used for location of SCSN catalog.

Other Supporting info for this manuscript includes:

**Dataset S1.** Seismicity catalog of relocated detections of 2001 earthquake sequence.
**Dataset S2.** Seismicity catalog of relocated detections of 2005 earthquake sequence.
**Dataset S3.** Seismicity catalog of relocated detections of 2010 earthquake sequence.
**Dataset S4.** Seismicity catalog of relocated detections of 2013 earthquake sequence.
Figure S1. Map view of $M \geq 5$ earthquakes in San Jacinto Fault Zone (SJFZ) from 1932 to 2016. Black box shows the study area in Figure 1.
Figure S2. Stations used for detection and relocation. AZ, CI and PB network stations are colored blue, red and green, respectively. Black box shows the study area in Figure 1.
Figure S3. Temporal evolution of M4 earthquakes in the trifurcation area (area in Figure 1) from 1932 to 2016.
Figure S4. Map view of seismicity colored by the relative distance from the main faults using different fault zone widths.
Figure S5. Distribution of focal mechanisms for each depth interval within the near-fault, off-fault, and intra-fault areas using different fault zone widths. Dashed line indicates the estimated geodetic locking depth from Fialko (2006).
Figure S6. Depth histograms of seismicity for different fault zone widths.
Figure S7. (left) Distribution of nearest-neighbor statistics for all available events in the trifurcation area of San Jacinto Fault zone (2000-2016) with different magnitude cutoff values. The white line shows the nearest-neighbor distance threshold used for clustering (based on Zaliapin and Ben-Zion, 2016). (right) Histogram of nearest-neighbor distance $\eta$. Red vertical lines denote the nearest-neighbor distance threshold used for clustering.
Figure S8. Estimated location errors for the 2001 M5.2, 2005 M5.0, 2010 M5.4 and 2013 M4.7 aftershock sequences. “For the 2016 Borrego Springs sequence, 95% of the relative errors are less than 150 m (horizontal) and 162 m (vertical).” (Ross et al., 2017)
Figure S9. Map view of seismicity for the 2005 M5.0, 2010 M5.4 and 2013 M4.7 aftershock sequences relocated using differential time data from all available stations (left) and only stations in Figure S1a (right). The characteristics of the relocated events are similar when using different station datasets for relocation.
Table S1. Velocity model used for GrowClust relocations. The velocity model assumes a layered structure with Vp/Vs ratio as 1.732. (Hutton et al., 2010)

<table>
<thead>
<tr>
<th>Depth (km)</th>
<th>Vp (km/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 – 5.5</td>
<td>5.5</td>
</tr>
<tr>
<td>5.5 – 16.0</td>
<td>6.3</td>
</tr>
<tr>
<td>16.0 – 32.0</td>
<td>6.7</td>
</tr>
<tr>
<td>32.0 – 99.0</td>
<td>7.8</td>
</tr>
</tbody>
</table>

Table S2. Location errors of the M > 4.5 earthquakes shown in Figure 1 (from Southern California Seismic Network (SCSN) standard catalog).