Supporting Information for:
Segmentation of the Main Himalayan Thrust illuminated by Bayesian inference of interseismic coupling

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Table S1. Long term slip rates and uncertainties from geomorphic studies used in this study.

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<thead>
<tr>
<th>Longitude</th>
<th>Slip rate (mm/yr)</th>
<th>Uncertainty (mm/yr)</th>
<th>Azimuth (°E)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>78.0</td>
<td>13.1</td>
<td>0.8</td>
<td>18</td>
<td>Thakur et al. (2014)</td>
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<td>82.0</td>
<td>19.0</td>
<td>1.5</td>
<td>12</td>
<td>Mugnier et al. (2004)</td>
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<td>85.8</td>
<td>18.2</td>
<td>6.0</td>
<td>8</td>
<td>Bollinger et al. (2014)</td>
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<tr>
<td>90.3</td>
<td>20.8</td>
<td>8.8</td>
<td>-5</td>
<td>Berthet et al. (2014)</td>
</tr>
</tbody>
</table>

Figure S1. Top view of the fault and GPS network (in the fixed-Indian reference frame) and levelling measurements employed in this study. **a**, GPS network is divided in the following subnetworks: block-1 (green), block-2 (blue), block-3 (yellow), block-4 (black), India (light blue), and Shillong (red). Dashed black lines are the boundaries between different regions of uniform long term slip rate. White triangular mesh is the fault discretization used in this model. **b**, Levelling data. The red line shows the surface trace of the Main Frontal Thrust.
<table>
<thead>
<tr>
<th>Event</th>
<th>Year</th>
<th>Mw</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lo Mustang</td>
<td>1505</td>
<td>8.2</td>
<td>Bilham (2004); Ambraseys and Douglas (2004); Bilham and Ambraseys (2005); Bollinger et al. (2016)</td>
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<td>Kashmir</td>
<td>1555</td>
<td>7.6</td>
<td>Bilham (2004); Ambraseys and Douglas (2004)</td>
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<td>Bhutan</td>
<td>1714</td>
<td>8.1</td>
<td>Hetényi et al. (2016); Le Roux-Mallouf et al. (2016)</td>
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<td>Uttar-Pradesh</td>
<td>1803</td>
<td>7.5</td>
<td>Ambraseys and Jackson (2003); Bilham (2004)</td>
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<tr>
<td>Kangra</td>
<td>1905</td>
<td>7.8</td>
<td>Wallace et al. (2005); Hough and Bilham (2008); Ambraseys and Douglas (2004)</td>
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<td>Bihar–Nepal</td>
<td>1934</td>
<td>8.2</td>
<td>S. Sapkota et al. (2013); S. N. Sapkota et al. (2016); Hough and Bilham (2008)</td>
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<td>Assam</td>
<td>1950</td>
<td>8.7</td>
<td>Khattri (1987); Bilham (2004)</td>
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<td>Kashmir</td>
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<td>7.6</td>
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<td>Gorkha</td>
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<td>7.8</td>
<td>Avouac et al. (2015); Duputel et al. (2016); Galetzka et al. (2015); Lindsey et al. (2015)</td>
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</table>

**Table S2.** List of the major historical earthquakes across the Himalayan arc.
Figure S2. Earth model: (a) P-wave velocity, (b) S-wave velocity and (c) Density used in this study for Green’s function (GF) calculations. The layered model used in this study for Green’s function (GF) calculations is plotted as a solid black line (Pandey et al., 1995). Dashed lines refer to the other models used to constrain the uncertainties on model prediction (Mahesh et al., 2013; Monsalve et al., 2006; Singer et al., 2017). Grey areas are the standard deviation of the probability density function, representing our confidence level on the elastic properties, as used to build the model prediction error ($C_p$).
Figure S3. Posterior mean coupling model of the Himalayan megathrust shown in Fig. 2 and residuals of (a) GPS data (with uncertainty ellipses) and (b) levelling data. Ellipses show the uncertainties at the 67% confidence level.
Figure S4. Posterior mean coupling model assuming a homogeneous convergence rate. The resulting posterior mean coupling model is obtained assuming a constant convergence rate along-strike, with no along-strike blocks (see Fig. S1). Thin black lines represent the fault parametrization. Solid blue line shows the surface trace of the Main Frontal Thrust.
Figure S5. Posterior mean coupling model assuming 5% uncertainty on the elastic properties of each layer of the elastic half-space (see Methods for details). For each of the histograms, orange bars are the marginal probability densities at discrete nodes of the fault model. Solid blue line shows the surface trace of the Main Frontal Thrust.
Figure S6. Comparison of coupling models, probability density functions and residuals of the GPS data.  

a, Top: posterior mean solution shown in Fig. 2 assuming a uniform prior. Bottom: posterior mean solution of model incorporating a strongly constrained 0-to-1 binary prior. Histograms indicate the marginal probability densities at discrete 6 nodes of the fault of models with uniform prior (grey) and binary prior (orange).  

b, Rosetta histograms showing the orientation of the residuals of the two models.  

c–d, Probability density distributions of residuals on both north and east velocity components.
Figure S7. Comparison between topography, interseismic coupling, and (micro-)seismicity. Seismicity within Nepal is from an NSC catalog (Ader et al., 2012). Seismicity between $\sim 77^\circ E$ and $81^\circ E$ is from Mahesh et al. (2013), and the remainder is from National Earthquake Information Center (NEIC). Solid coloured lines show the topography contour lines. Dashed blue lines indicate the location of the Kaurik-Chango, Thakola, and Yadong rifts. Orange patches indicate the location of the subsurface ridges beneath the Indo-Gangetic Plains. The Main Frontal Thrust is outlined in red.
References


Bilham, R., & Ambraseys, N. (2005). Apparent himalayan slip deficit from the summation of


Hetényi, G., Roux-Mallouf, L., Berthet, T., Cattin, R., Cauzzi, C., Phuntsho, K., . . . others (2016). Joint approach combining damage and paleoseismology observations constrains the 1714 ad bhutan earthquake at magnitude $8 \pm 0.5$. *Geophysical Research Letters,* 43(20).


