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Triggering of the 2014 M_w7.3 Papanoa earthquake by a slow slip event in Guerrero, Mexico

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Data	λ (km)	σ_{m0} (m)	Azimuth θ	χ^2	Number of GPS stations
Flat slab fault geometry					
2014 SSE	80	$10^{-1.4}$	-152	1.7991	20
Inter-SSE trend	80	$10^{-1.4}$	31	0.2388	39
Long-term trend	80	$10^{-1.4}$	45	0.3350	28
Papanoa earthquake	20	$10^{-0.8}$	-168	0.0892	20
USGS fault geometry					
2014 SSE	80	$10^{-1.4}$	-150	1.7882	20
Inter-SSE trend	80	$10^{-1.4}$	31	0.3028	39
Long-term trend	80	$10^{-1.4}$	43	0.5745	28
Papanoa earthquake	20	$10^{-0.8}$	-162	0.305	20

Table S1: Parameters of the inversion.

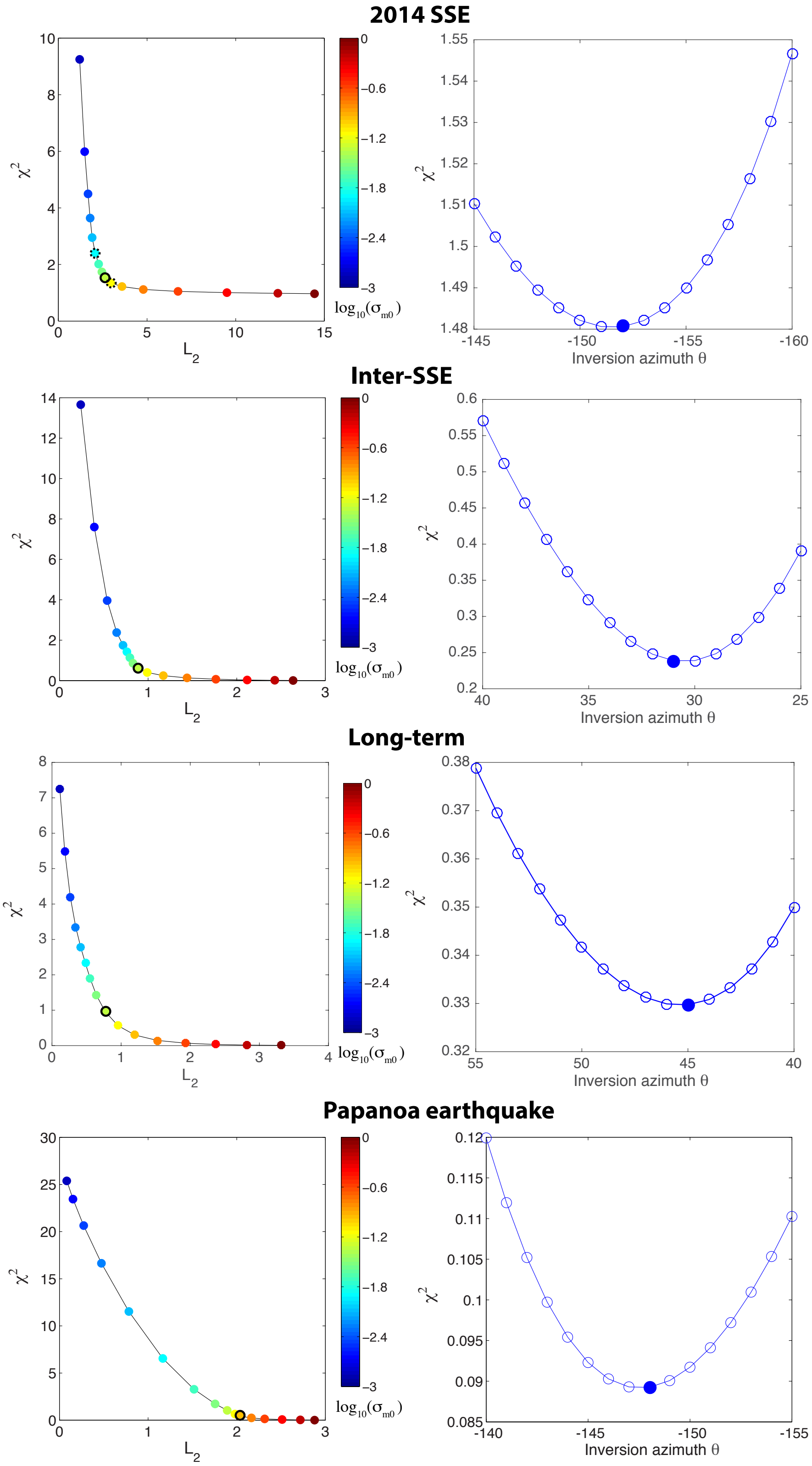

Figure S1: Selection of damping parameter and optimal inversion azimuth for all inversion cases. **Left column**: selection of the damping parameter: the data misfit (Chi-square χ^2), is plotted as a function of the size of the regularized solution (L_2 norm) for different damping values σ_{m0}. Selected value is encircled in black. In top right plot, additional smoothing tested in Fig.S10 are encircled in dashed line. The computation is made with an ad-hoc azimuth equal to the convergence direction: Θ equals $-158°$ for SSE and Θ equals $32°$, corresponding to backslip, for coupling analysis. **Right column**: selection of the optimal inversion azimuth. The previously determined damping is selected, and the optimal azimuth corresponding to the lowest χ^2 value (filled symbol) is chosen.

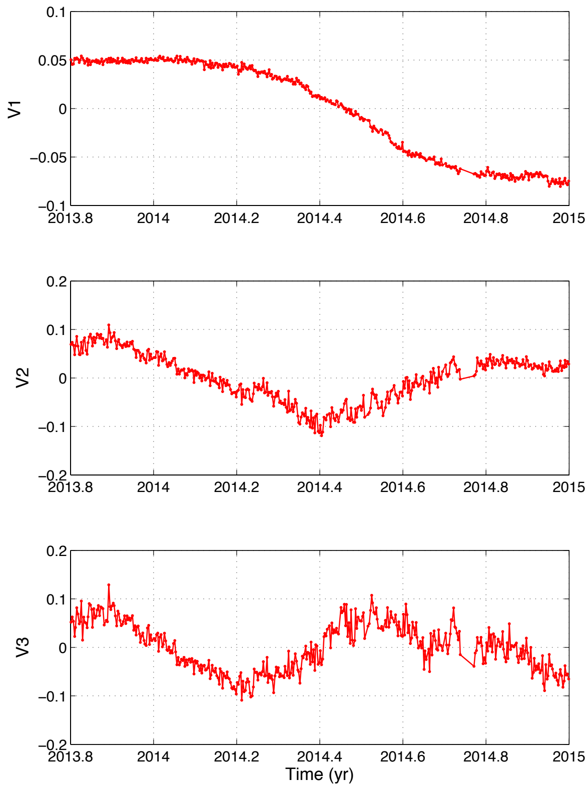

Figure S2: Eigenvectors (V_1, V_2 and V_3) of the PCA decomposition, for the first three components. The associated eigenvalues are respectively $S_1 = 2.11$, $S_2 = 0.49$ and $S_3 = 0.32$.

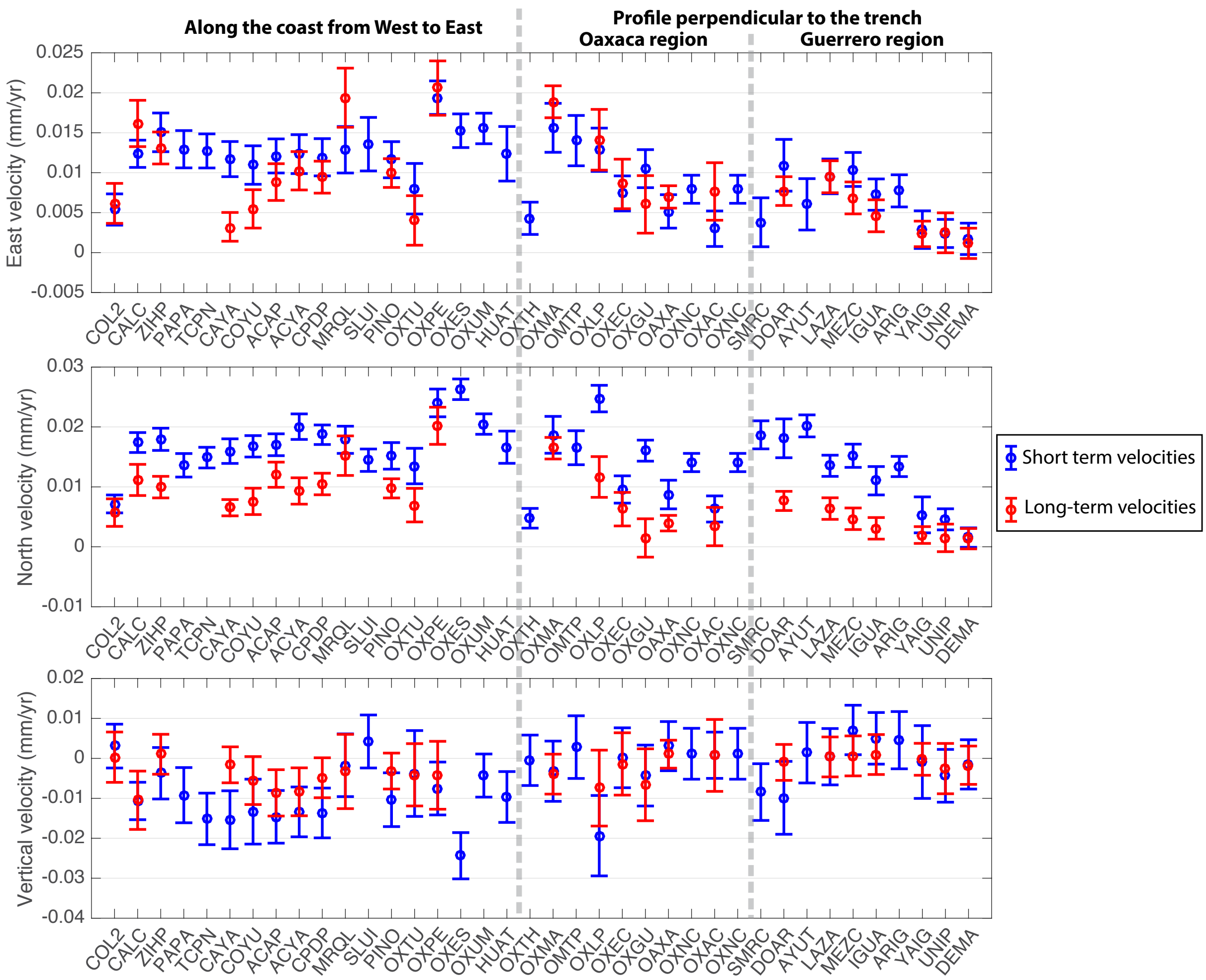

Figure S3: Values and error bars of short-term (blue dots) and long-term (red dots) velocities for all GPS stations used in this study, for the East (top), North (center) and Vertical (bottom) components. Note that for some stations, the long-term velocities cannot be evaluated due to short time series. Vertical grey dashed lines separate GPS stations according to their positions (as indicated in the title of top figure).

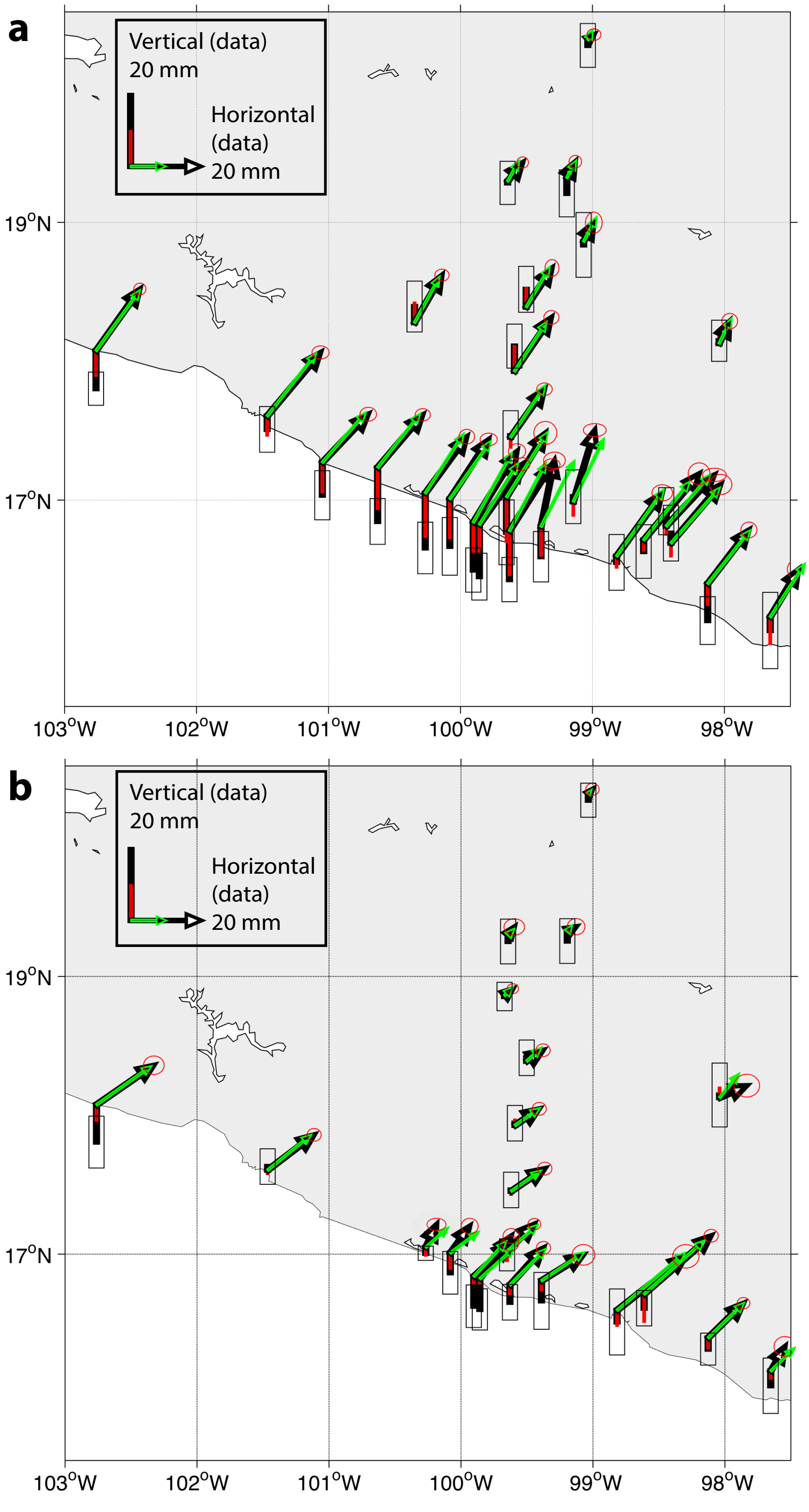

Figure S4: Data and modeled inter-SSE velocities (**a.**) and long-term velocities ((**b.**). Data are represented by black arrows and vertical bars, for horizontal and vertical motion, respectively. Model predictions are shown by green arrows for horizontal motion and red bars for vertical motion. 1-sigma data uncertainties are presented as red ellipses for horizontal displacements and black rectangles for vertical ones.

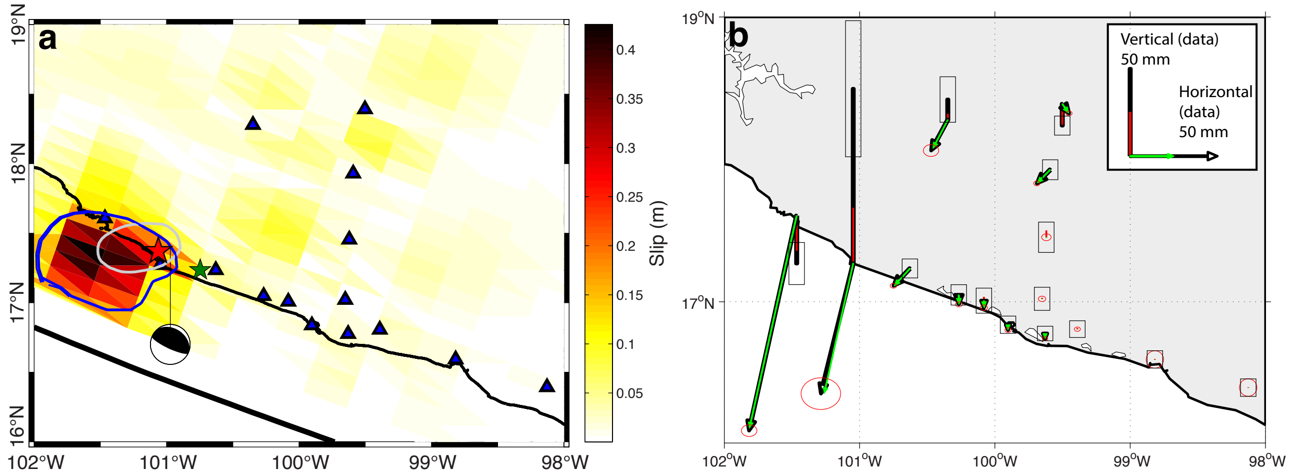

Figure S5: Papanoa earthquake slip model. **A.** Slip model, with blue contour for slip > 0.15m. The slip contour published by the UNAM group [1] (slip > 0.5 m) is shown in gray. **B.** Displacement vectors. Data are represented by black arrows and vertical bars, for horizontal and vertical motion, respectively. Model predictions are shown by green arrows for horizontal motion and red bars for vertical motion. 1-sigma data uncertainties are presented as red ellipses for horizontal displacement and black rectangles for vertical ones. Red and green stars are respectively the hypocentral location of the Papanoa earthquake (M_w7.3) and its largest aftershock(M_w6.4).

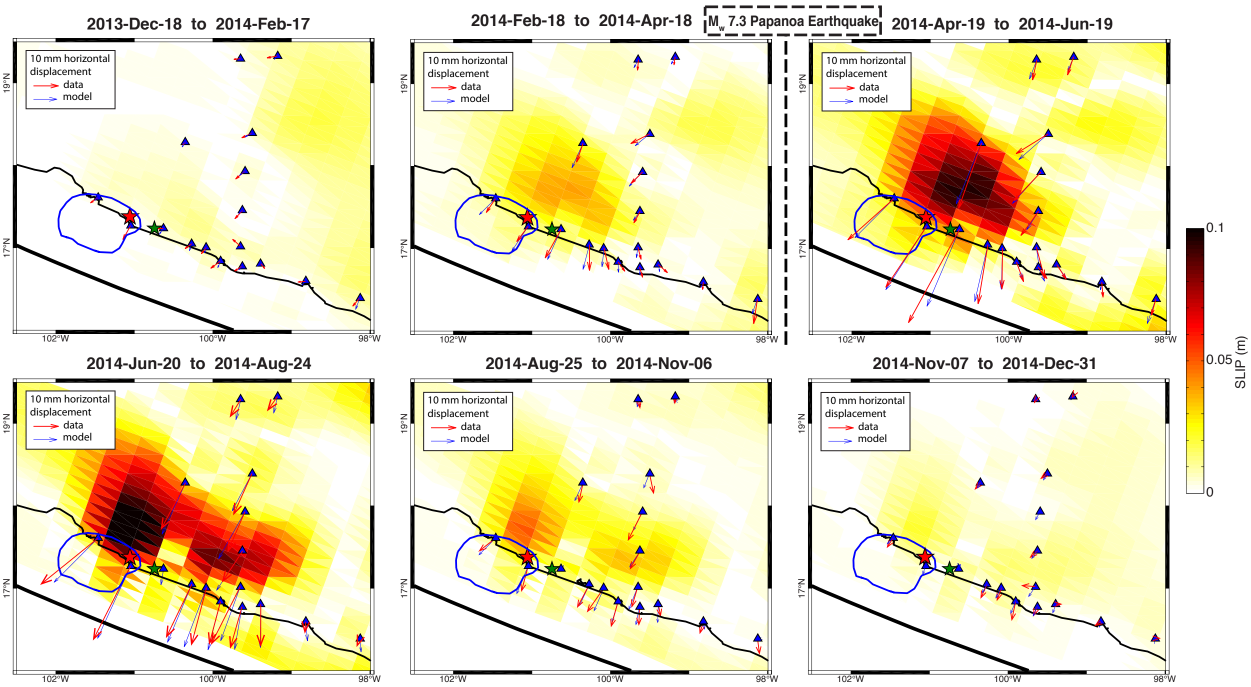

Figure S6: Time evolution of the slow slip event. Each snapshot covers a period of 60 days (55 days for the last one). The first two snapshots show the slow slip before the April 18th M_w7.3 Papanoa earthquake, the last four snapshots the slow slip after the earthquake. Red and blue vectors are respectively the data and modeled horizontal surface displacements for each time period. When data points are missing at the starting or ending date of a given snapshot, the data vector is evaluated by interpolation of a smoothed data time series (see Fig.S7 for complete time series revealing missing data points). Thick black line is the Middle American Trench, thin black line the coast. Blue line is the Papanoa earthquake contour (see Fig.S5). Blue triangles are GPS stations used in this study. Red and green stars are respectively the hypocentral location of the Papanoa earthquake (M_w7.3) and its largest aftershock(M_w6.4).

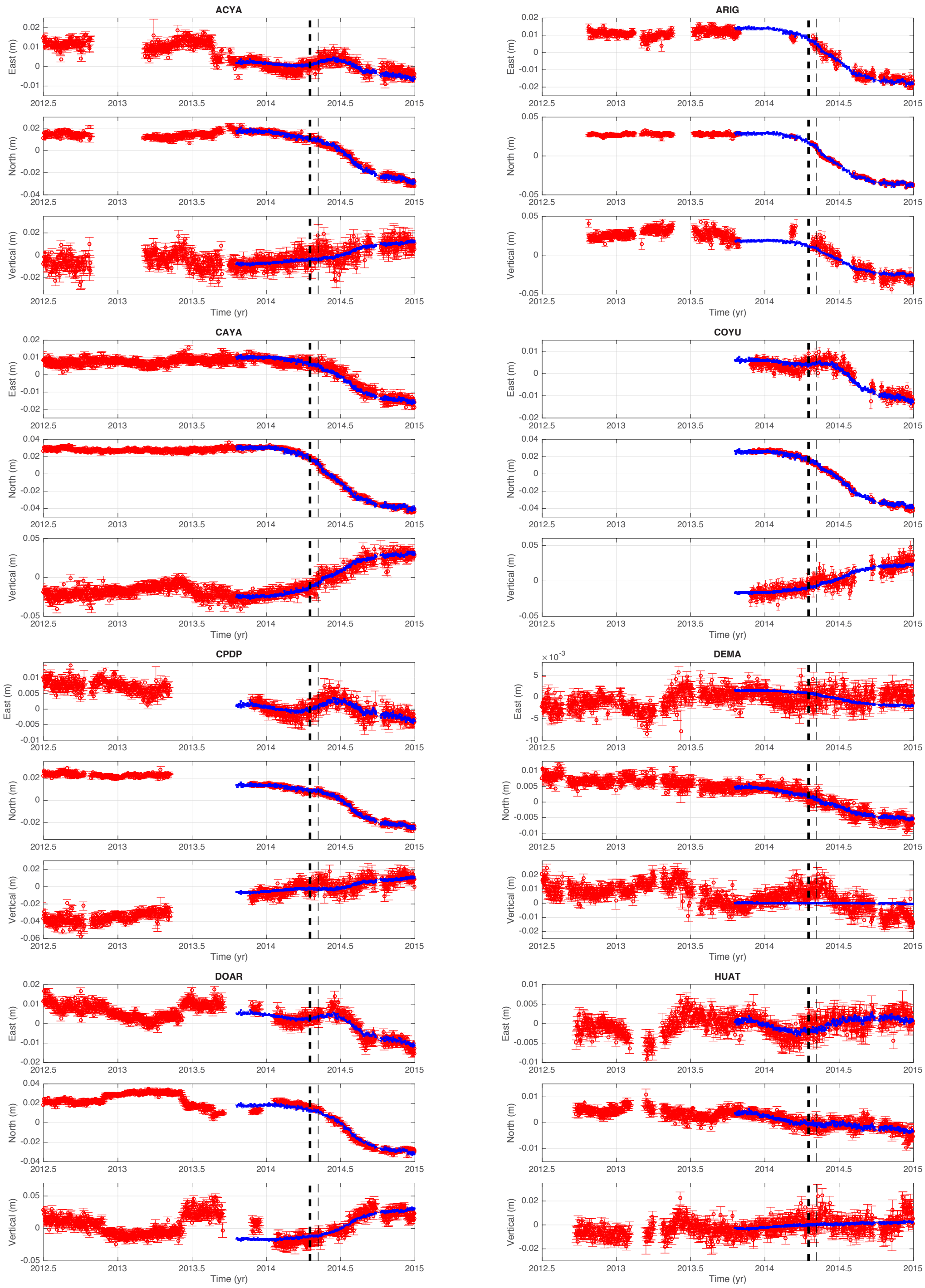

Figure S7: Position GPS time series for the 2014 SSE. Data (in red) are shown starting 2012.5 to reflect inter-SSE data variability. Model (in blue) is shown over the inversion period, from 2013.8 until 2015. The time of the Papanoa earthquake (April 18^{th}) and its main aftershock (May 8^{th}) are displayed as thick and thin dashed vertical lines, respectively.

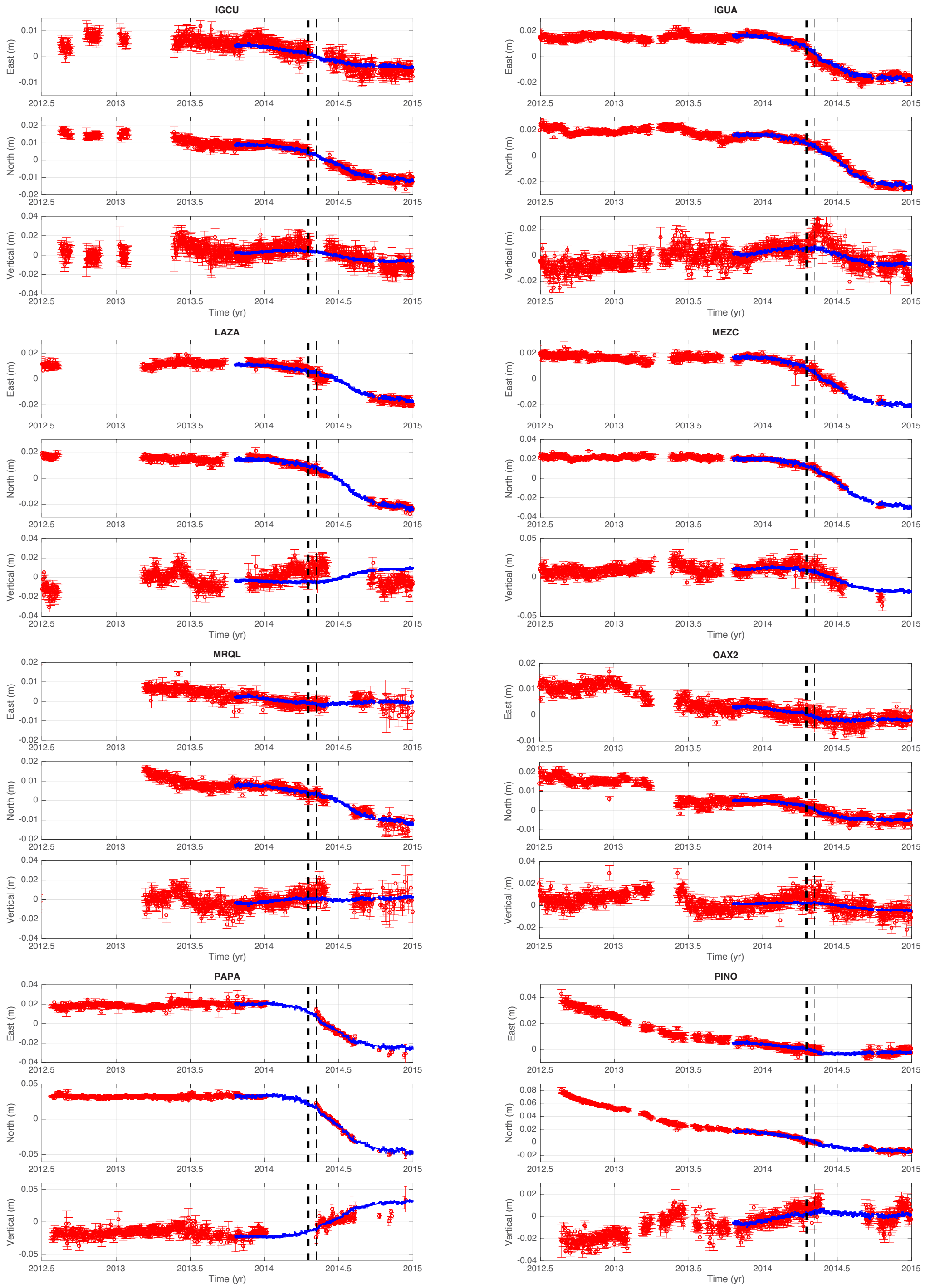

Figure S7: (continued)

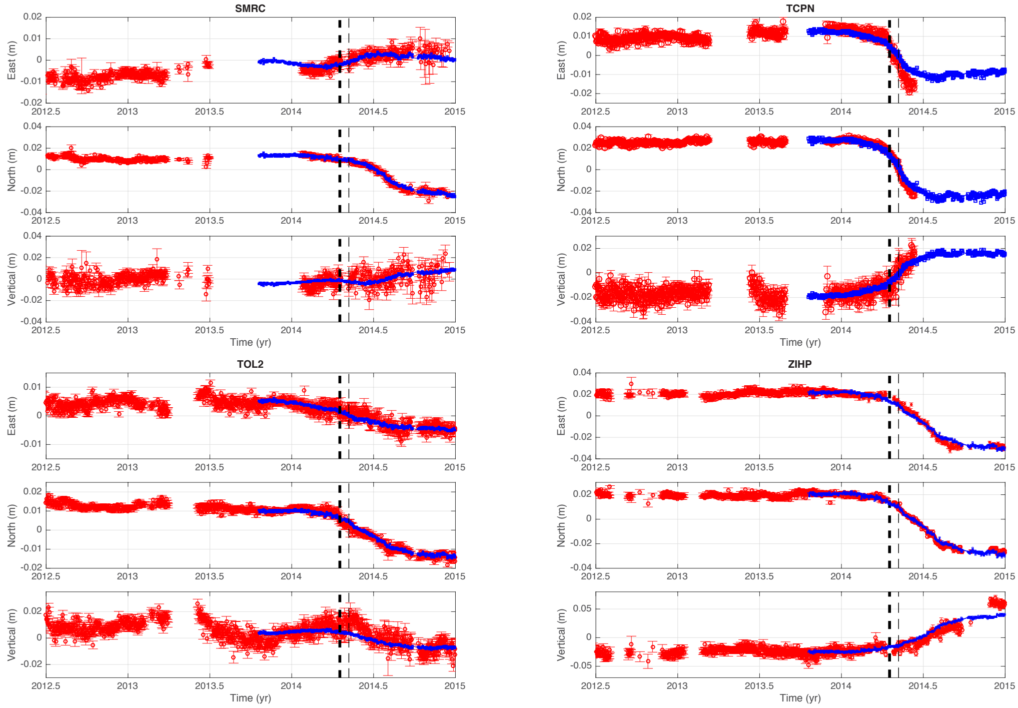

Figure S7: (continued)

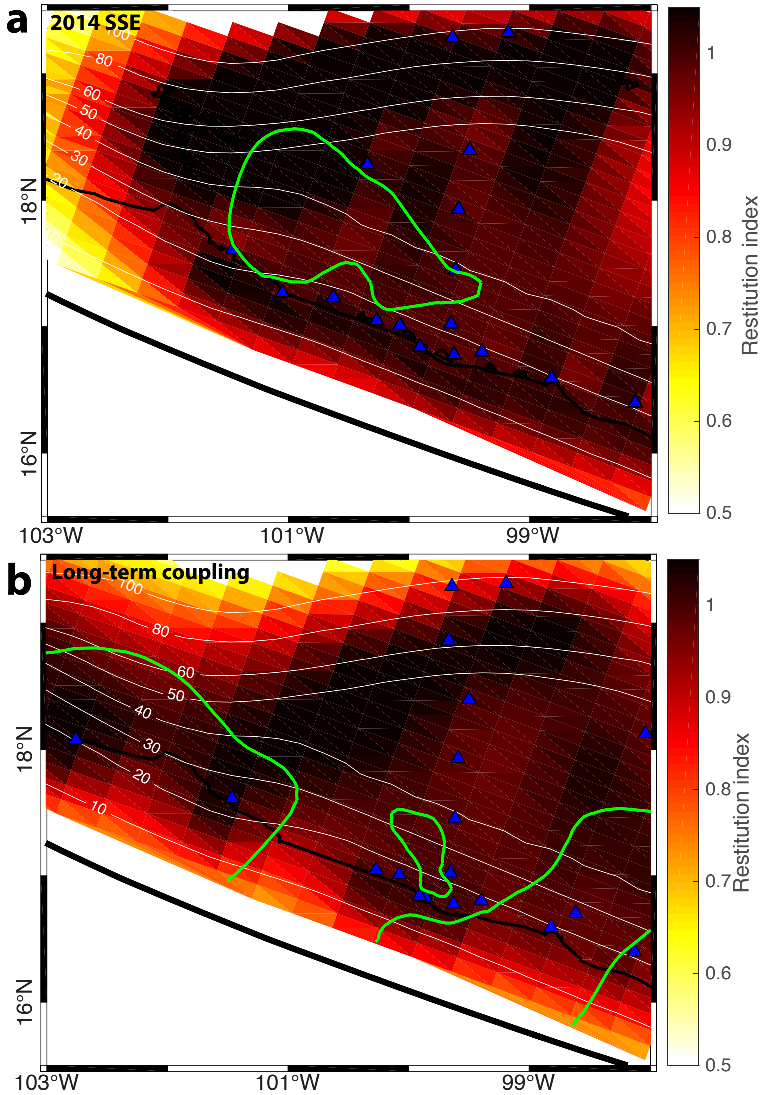

Figure S8: Resolution of the inversions. The restitution index (sum of the rows of the resolution matrix), is shown. Values close to one indicate that the local mean slip amplitude is correctly retrieved by the inversion. Low values (<0.5) indicate poorly resolved areas. **a.** Resolution for the 2014 SSE. The restitution index is shown for the first component of the decomposition. Results are similar for all components. The slow slip model (green contour) is located in a well resolved area. **b.** Resolution of the inversion for the long-term coupling. The green lines correspond to the 0.5 coupling ratio contour (coupling from Fig.3c). Note that the observed along-coast coupling variability is independent of the resolution value.

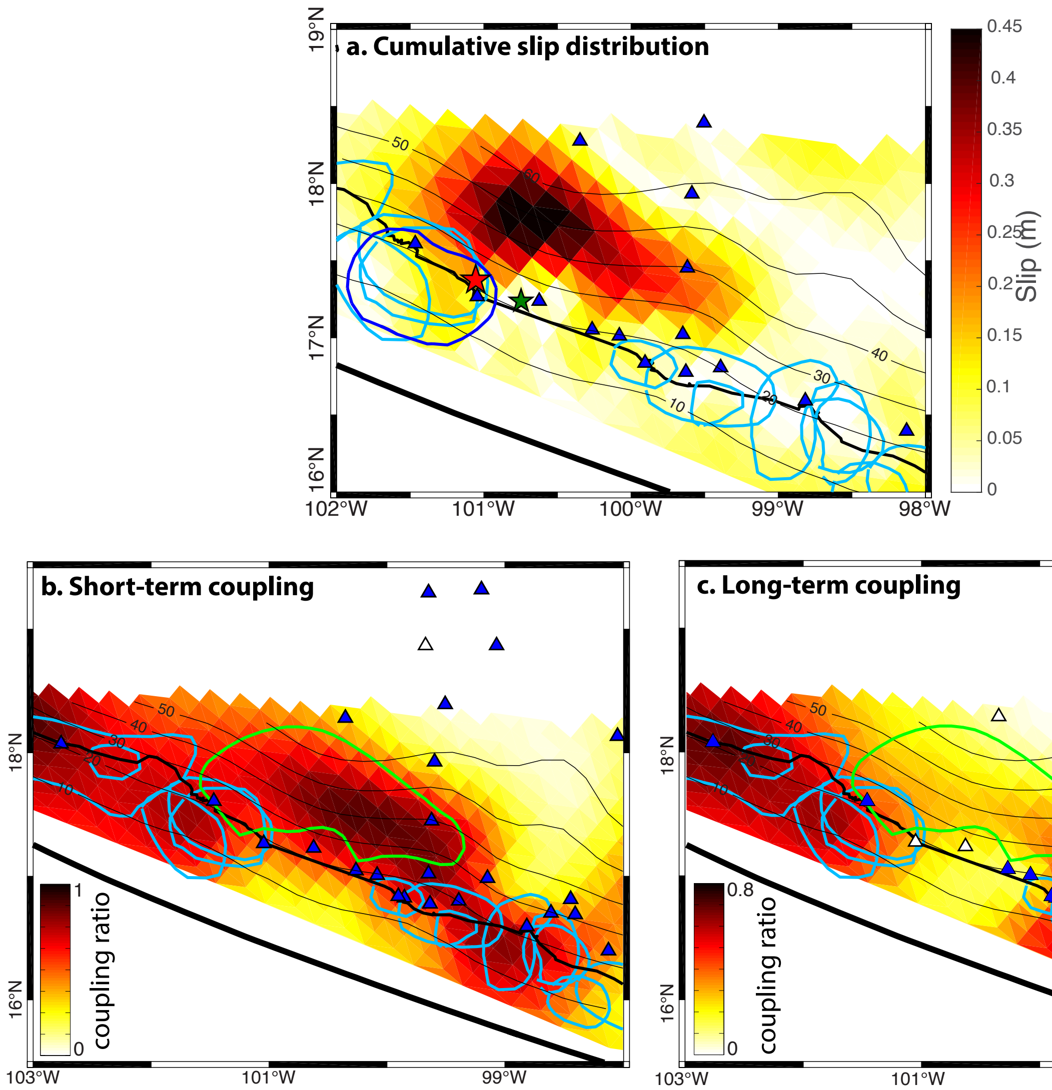

Figure S9: Inversion results considering the alternative Slab 1.0[2] subduction geometry. **a.** Cumulative slip distribution for the 2014 SSE. **b.** Short-term coupling. **c.** Long-term coupling. Light blue lines are large earthquake contours since 1940. Dark blue line is the Papanoa earthquake contour (in a). Green line is the 2014 SSE contour (in b and c). Blue triangles: GPS stations used in this study. White triangles: other stations not used.

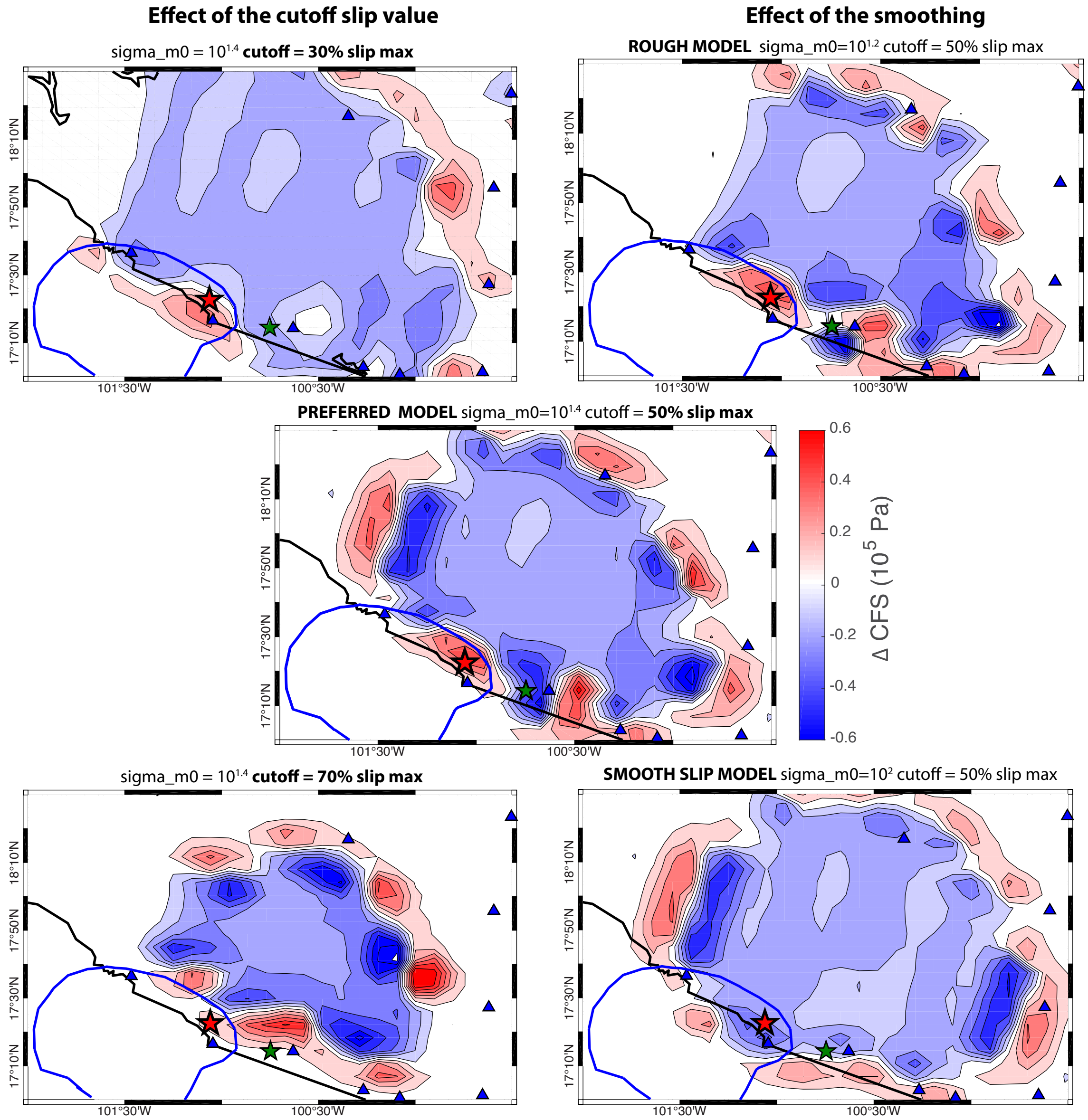

Figure S10: Variability in the Coulomb failure stress changes on the subduction interface for the "flatslab" subduction geometry. On the left, different cutoff slip values of 30%, 50% (preferred model) and 70% of the maximum slip are tested. On the right, different smoothing are tested with a rough model (top) and a smooth model (bottom). The figure in the center is our preferred model. Thick black line: Middle American Trench. Blue triangle: GPS station location. Stars show earthquake epicenters: the April 18th Papanoa earthquake (M_w7.3) in red, and the largest aftershock of May 8th M_w6.4 (green star). Blue line is the Papanoa earthquake slip contour.

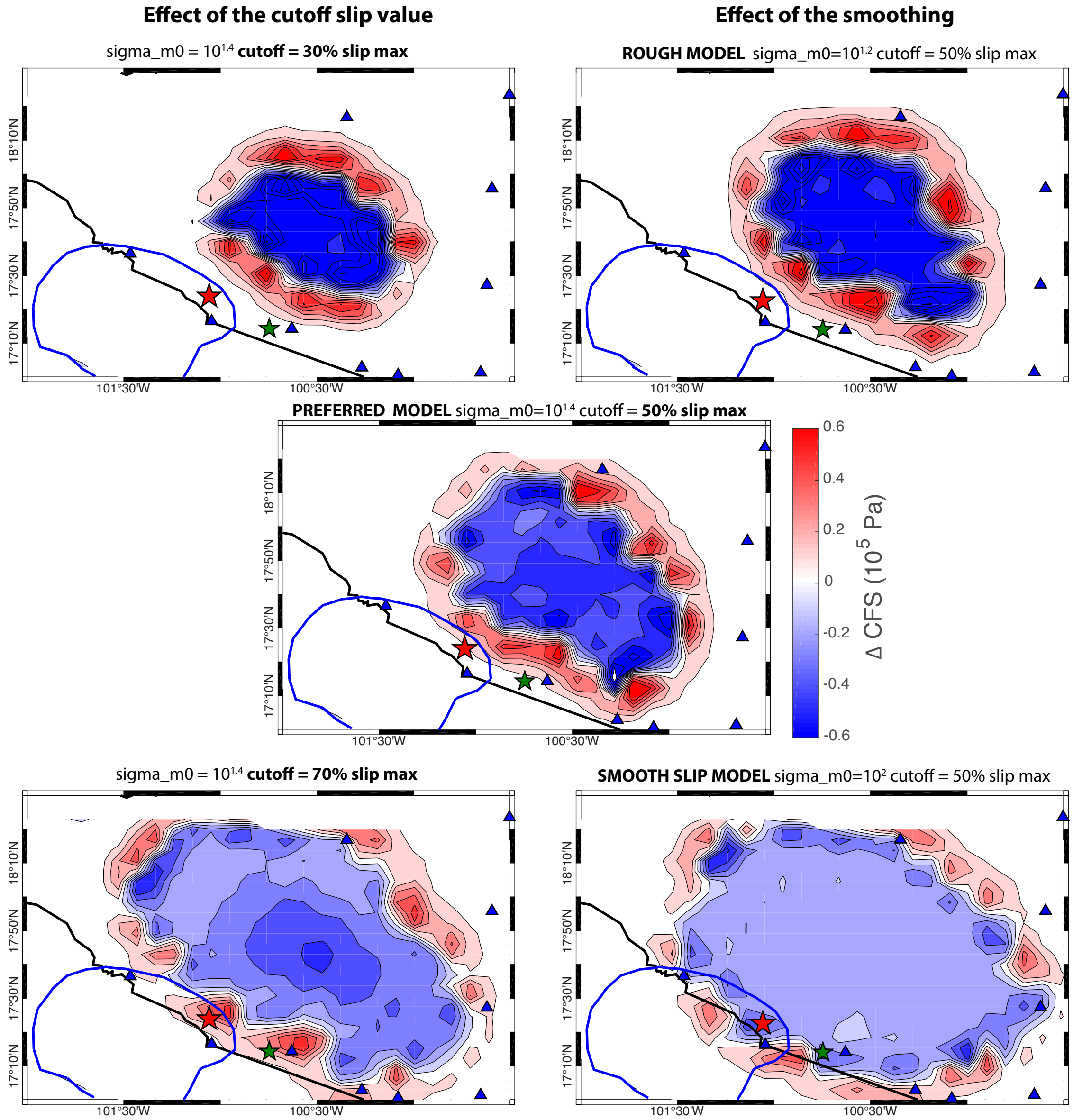

Figure S11: Variability in the Coulomb failure stress changes on the subduction interface for the alternative Slab 1.0[2] subduction geometry. On the left, different cutoff slip values of 30%, 50% (preferred model) and 70% of the maximum slip are tested. On the right, different smoothing are tested with a rough model (top) and a smooth model (bottom). The figure in the center is our preferred model. Thick black line: Middle American Trench. Blue triangle: GPS station location. Stars show earthquake epicenters: the April 18$^{\text{th}}$ Papanoa earthquake (M_w7.3) in red, and the largest aftershock of May 8$^{\text{th}}$ M_w6.4 (green star). Blue line is the Papanoa earthquake slip contour.

References

[1] UNAM Seismology Group. Papanoa, Mexico earthquake of 18 April 2014 (Mw 7.3). *Geofísica Internacional* **54**, 363–386 (2015).

[2] Hayes, G. P., Wald, D. J. & Johnson, R. L. Slab1.0: A three-dimensional model of global subduction zone geometries. *J. Geophys. Res.* **117**, B01302 (2012).