Supplementary Material

The supplementary material includes figures of coseismic stress changes with variable fault geometry (Figure S1), interseismic stress change (Figure S2), poroelastic stress change from the 2000 earthquake with variable fluid saturation depths (Figure S3), earthquake catalog histograms (Figure S4), seismicity rate change from different time periods (Figure S5 & S6), and stress changes at 2007 hypocenter using variable fault friction (Figure S7).

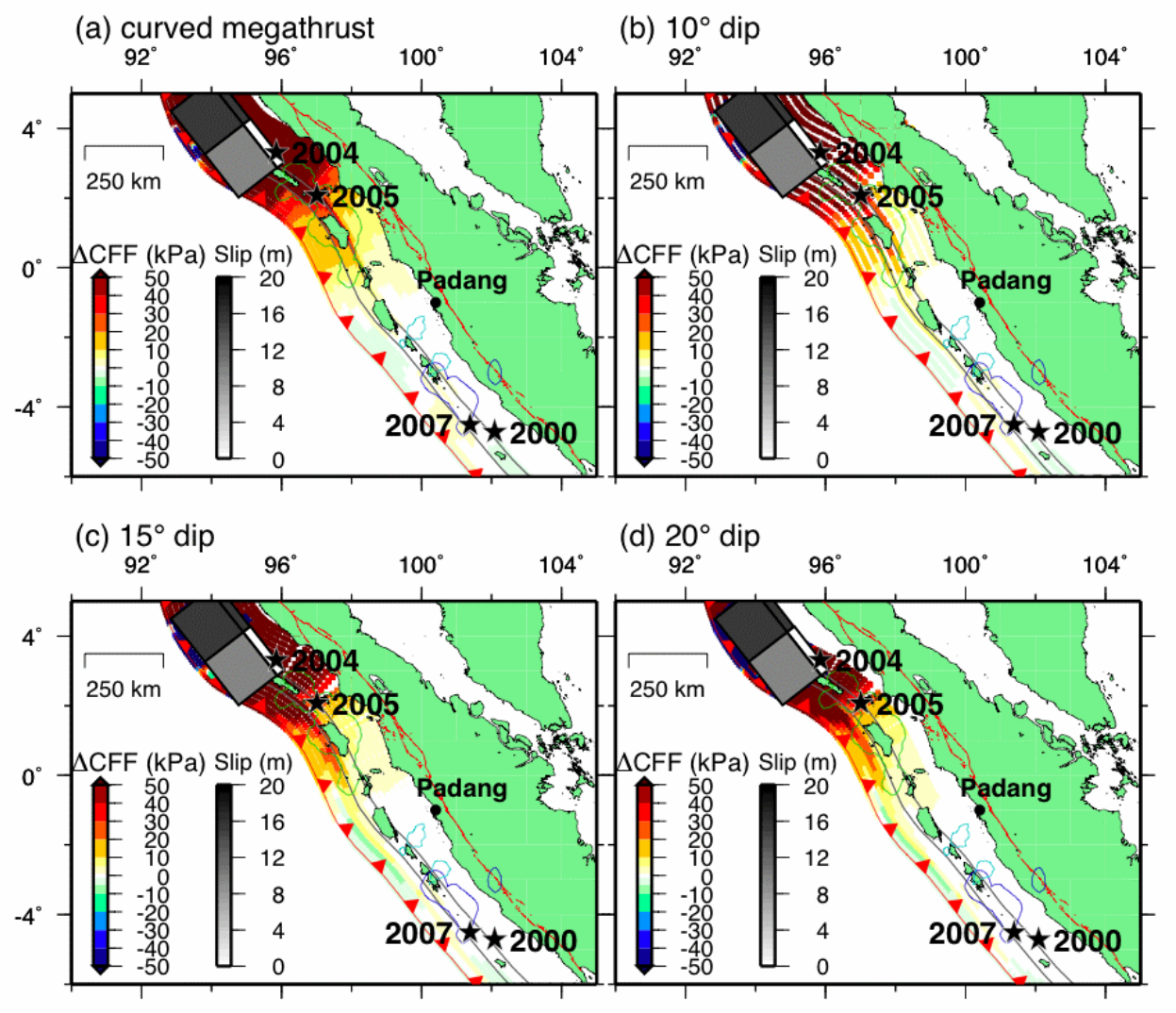

Figure S1. Sumatra coseismic CFF change resolved on a) preferred curved megathrust, b) 10° dipping plane, c) 15° dipping plane, and d) 20° dipping plane. All of the CFF maps cover the same depth range. The main difference between the varied models is the location of the high stress region that extends past Siberut. This increase in CFF change is due to the increase in elastic stiffness parameters at 15 km and 25 km depth and the downdip edge of the rupture at 30 km depth. The geometrical differences insubstantially impact the CFF change values at the deeper portions of the megathrust, at depths greater than the source model.

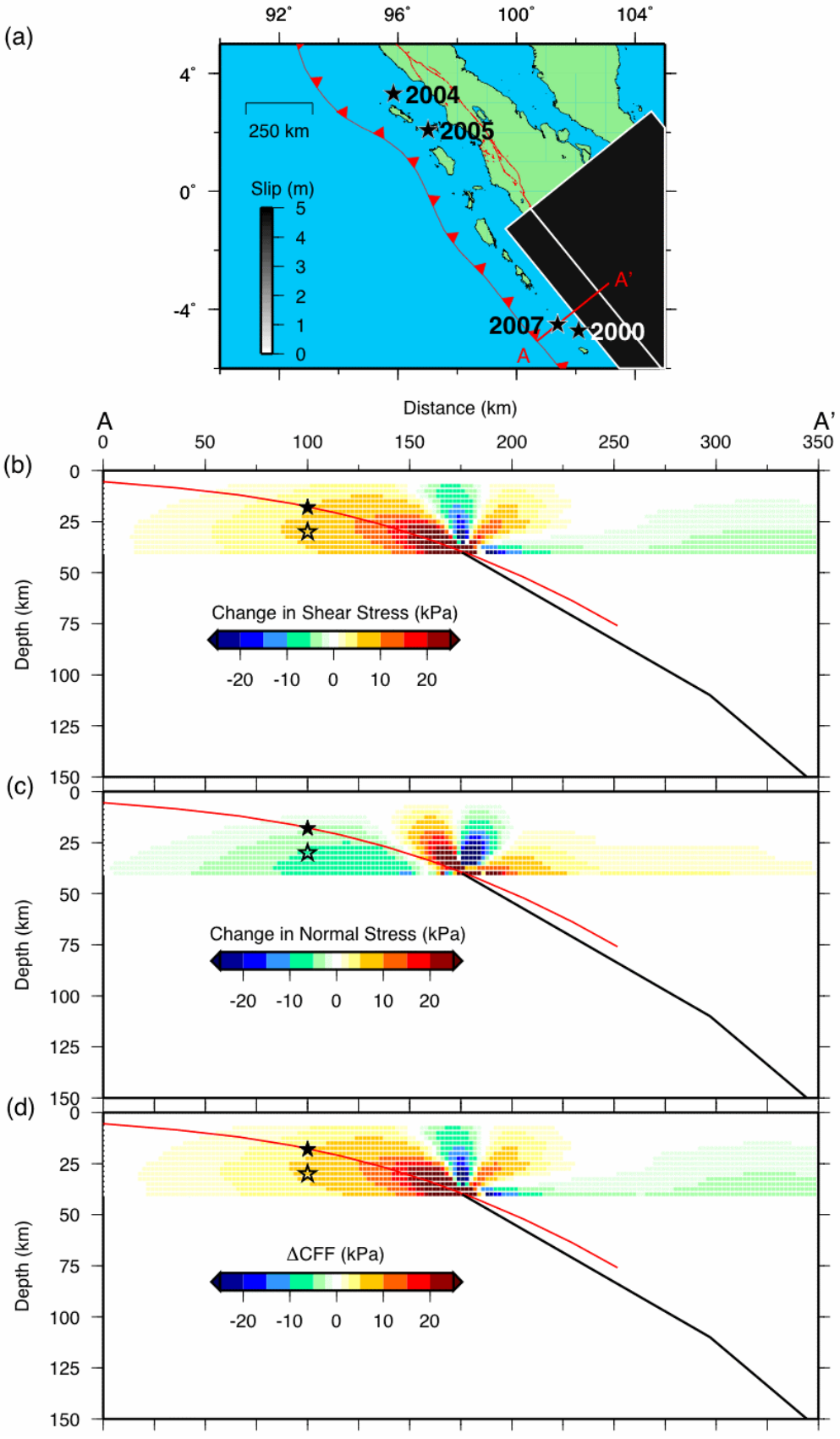
(a)
92°
96°
100°
104°
4°
0°
-4°
2004
2005
2007
2000
250 km
Slip (m)
5
4
3
2
1
0
A
A'
Distance (km)
A
A'
0
50
100
150
200
250
300
350
(b)
Depth (km)
Change in Shear Stress (kPa)
-20
-10
0
10
20
(c)
Change in Normal Stress (kPa)
(d)
ΔCFF (kPa)

Figure S2. Two-plane interseismic model for the 2007 hypocentral region. a) The two-plane interseismic model approximates the geometry of the curved megathrust with plane-1 extending from 40 to 110 km depth at a 30° dip and plane-2 extending from 110 to 600 km depth at a 40° dip. Both planes have a uniform 4.5 cm/yr reverse slip and extend along strike for 800 km. Interseismic annual stressing rates are shown at cross section A-A' for b) shear stress, c) normal stress, and d) CFF with μ' = 0.1. The black planes are the source faults and the red planes are the receiver fault (preferred megathrust geometry). The 2007 hypocenter on our preferred megathrust geometry is shown by a filled star and the USGS hypocenter is shown by an open star. The CFF change is 5 kPa/year at our preferred hypocenter and 6 kPa/year at the USGS hypocenter.

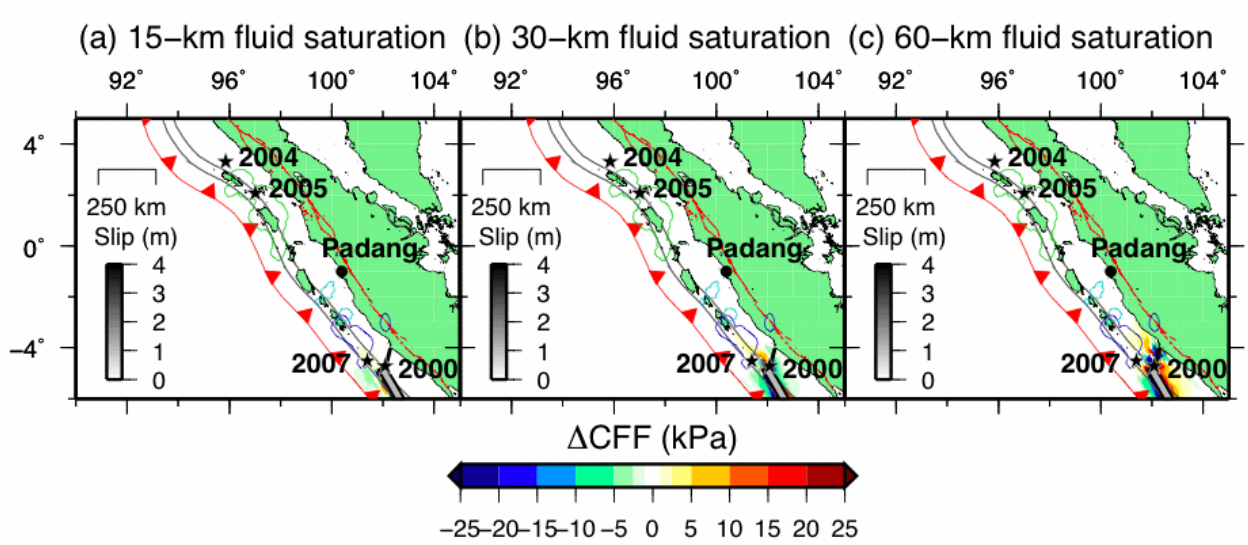

Figure S3. 2000 poroelastic CFF change model for a) pore-fluid saturation down to 15-km depth, b) pore-fluid saturation down to 30-km depth, and c) pore-fluid saturation down to 60-km depth. Although the extent of the large poroelastic CFF changes increases with increased pore-fluid saturation depth, the 2007 hypocenter is too distant to be sensitive to these changes.

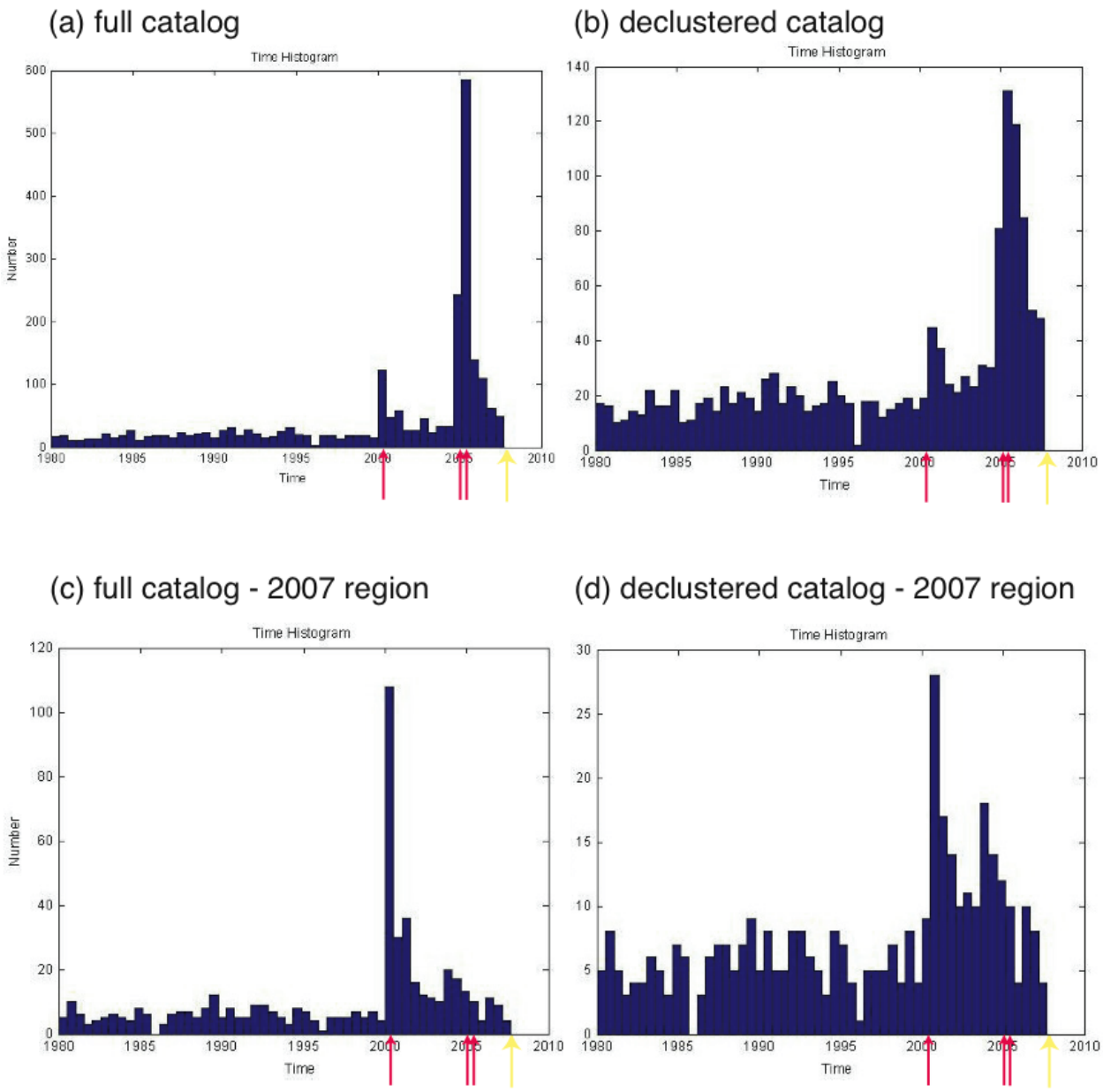

Figure S4. M ≥ 4.7 and depth < 100 km seismicity from a) full catalog, b) declustered catalog, c) catalog restricted to 2007 epicentral region, and d) declustered catalog restricted to 2007 epicentral region. The red arrows point to the 2000, 2004, and 2005 earthquakes and the yellow arrow points to the 2007 earthquake.

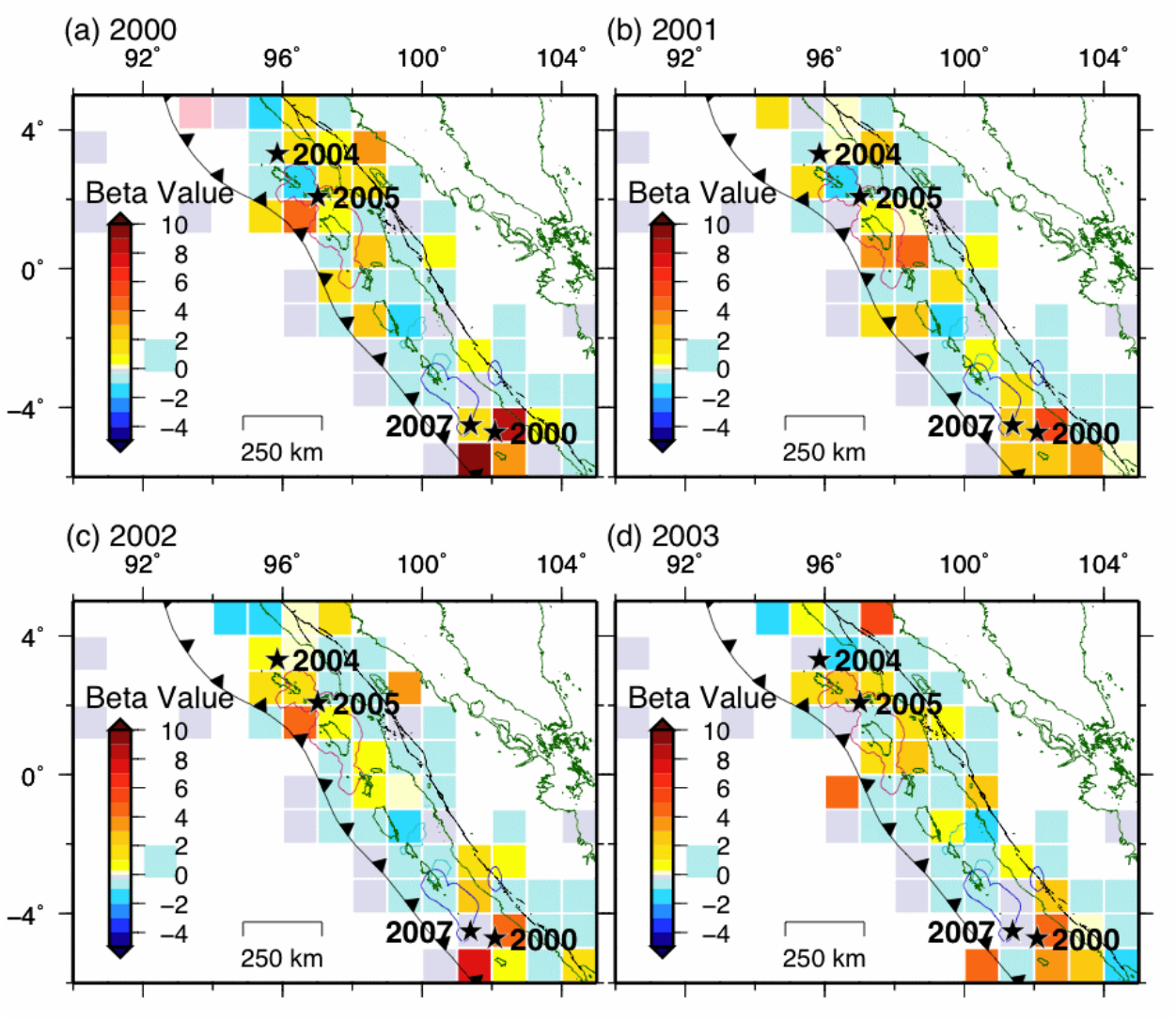

Figure S5. Beta values showing the relative change in seismicity compared to the time period 1980-1999. For the year: a) 2000, b) 2001, c) 2002, and d) 2003. The pink squares signify regions with aftershocks where there were no earthquakes during the preseismic period. The 2005 slip contour (Konca *et al.*, 2007) and 2007 slip contours (Konca *et al.*, 2008) overlay the beta values.

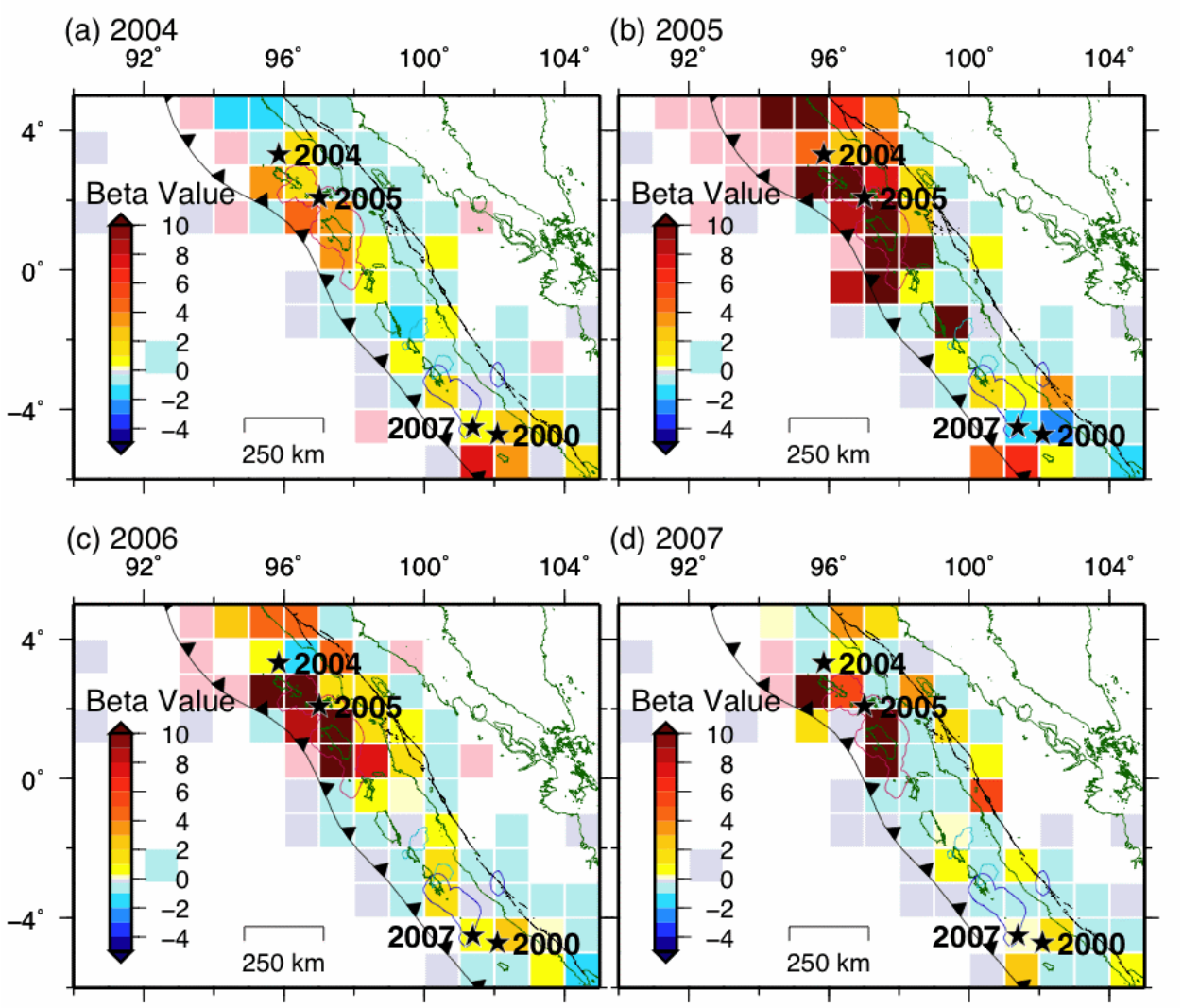

Figure S6. Beta values showing the relative change in seismicity compared to the time period 1980-1999. For the year: a) 2004, b) 2005, c) 2006, and d) 2007 up to the September earthquake. The pink squares signify regions with aftershocks where there were no earthquakes during the preseismic period. The 2005 slip contour (Konca *et al.*, 2007) and 2007 slip contours (Konca *et al.*, 2008) overlay the beta values.

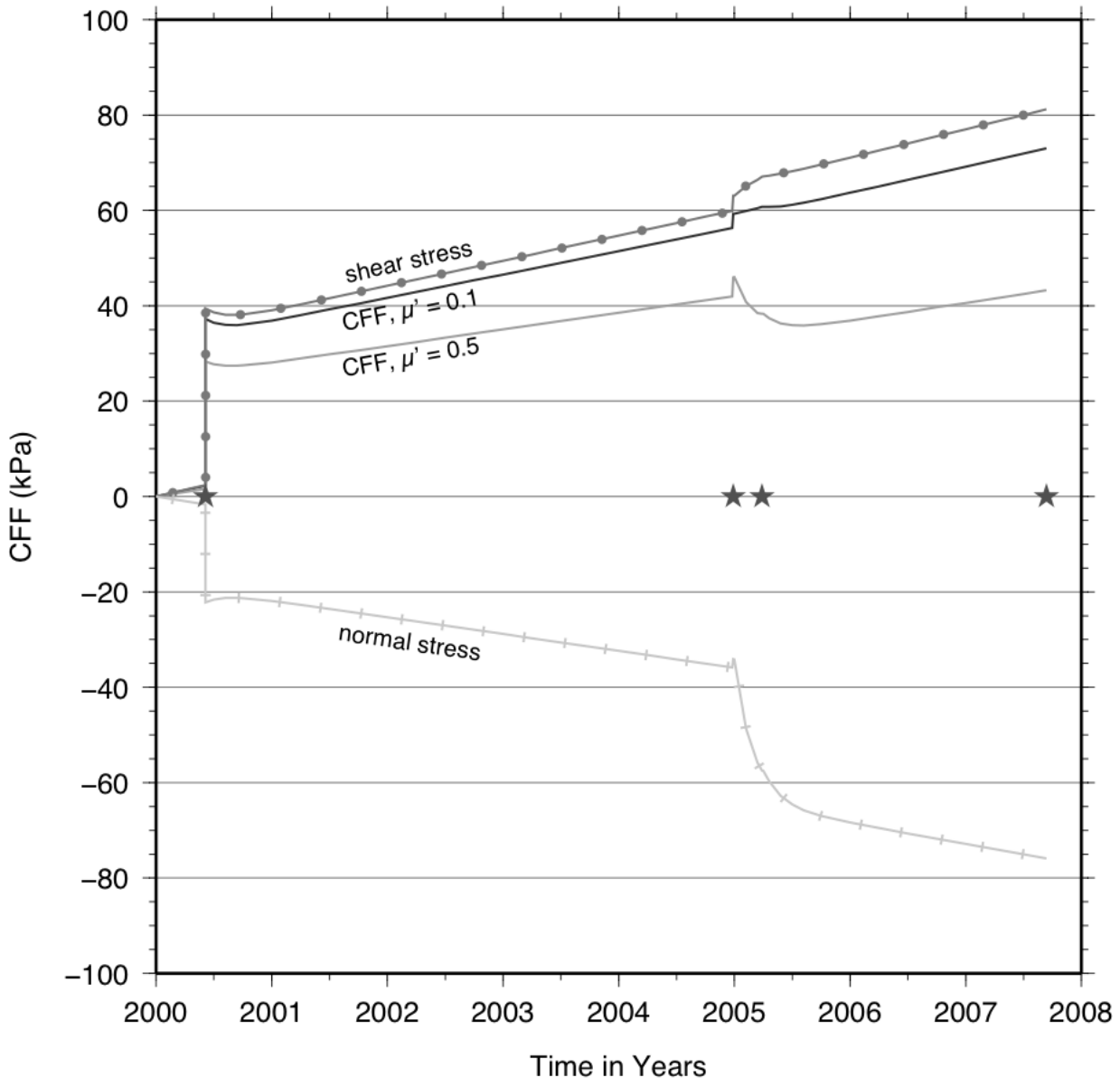

Figure S7. Accumulated stress change at the 2007 hypocenter since the time of the 2000 earthquake. The normal stress change, shear stress change, and CFF change (μ' = 0.1 and 0.5) is plotted at the average hypocentral depth (between our 18 km depth and the USGS 30 km depth). The accumulated CFF change includes coseismic and postseismic stress changes from the 2000, 2004, and 2005 earthquakes along with an interseismic stressing rate. Lacking knowledge of their time-dependence, the poroelastic and afterslip stress changes are added to the coseismic stress changes for the 2000, 2004, and 2005 earthquakes. The timing of the 2000, 2004, 2005, and 2007 earthquakes are marked with stars.