Journal of Geophysical Research

Supporting Information for

The Shear Deformation Zone and the Smoothing of Faults with Displacement

Clément Perrin[1,2,*], Felix Waldhauser[1] and Christopher H. Scholz[1]

[1] Lamont Doherty Earth Observatory at Columbia University, New York, USA

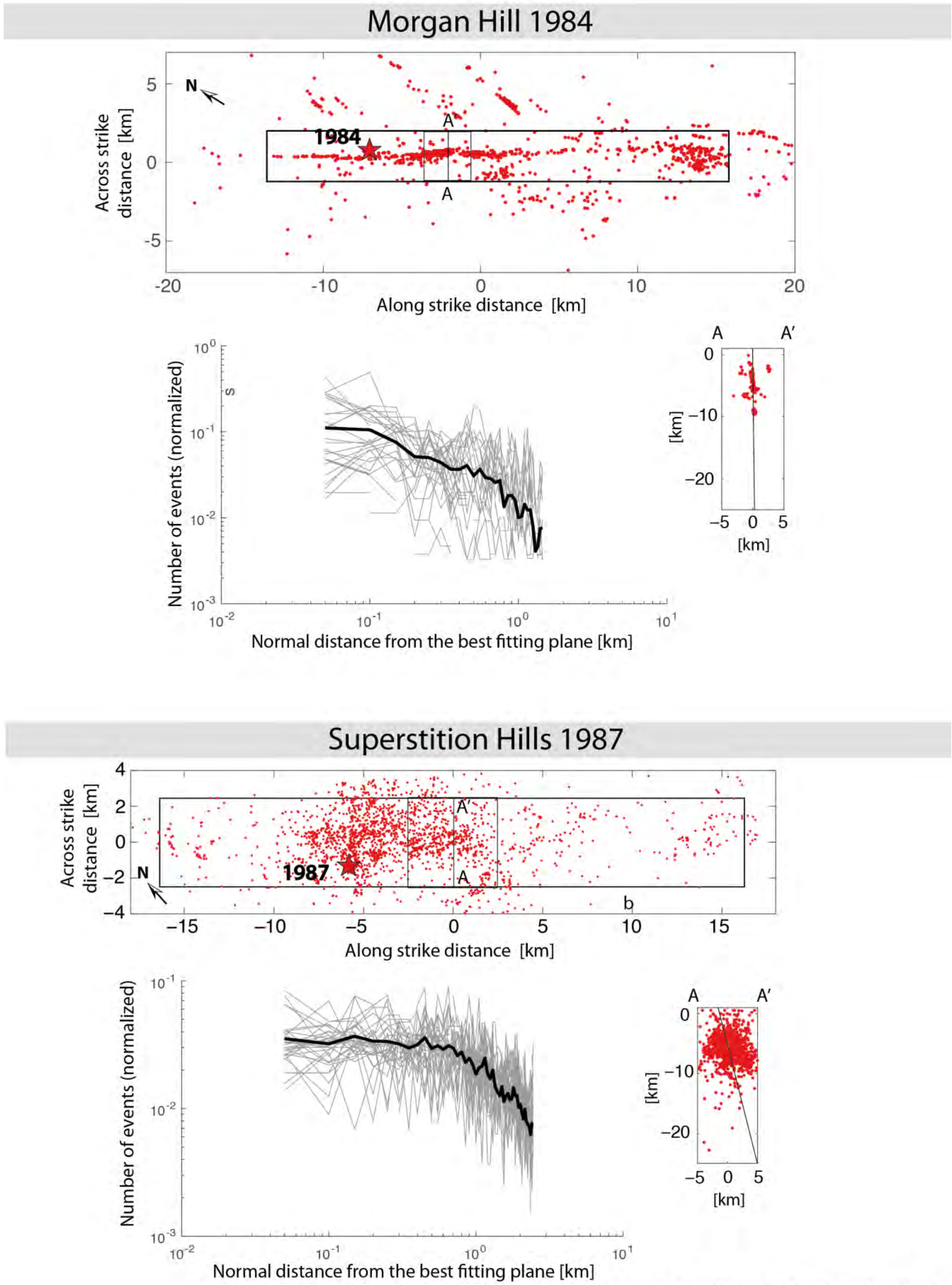
[2] Present address: Université de Paris, Institut de physique du globe de Paris, CNRS, F-75005 Paris, France

[*] **Corresponding author: perrin@ipgp.fr**

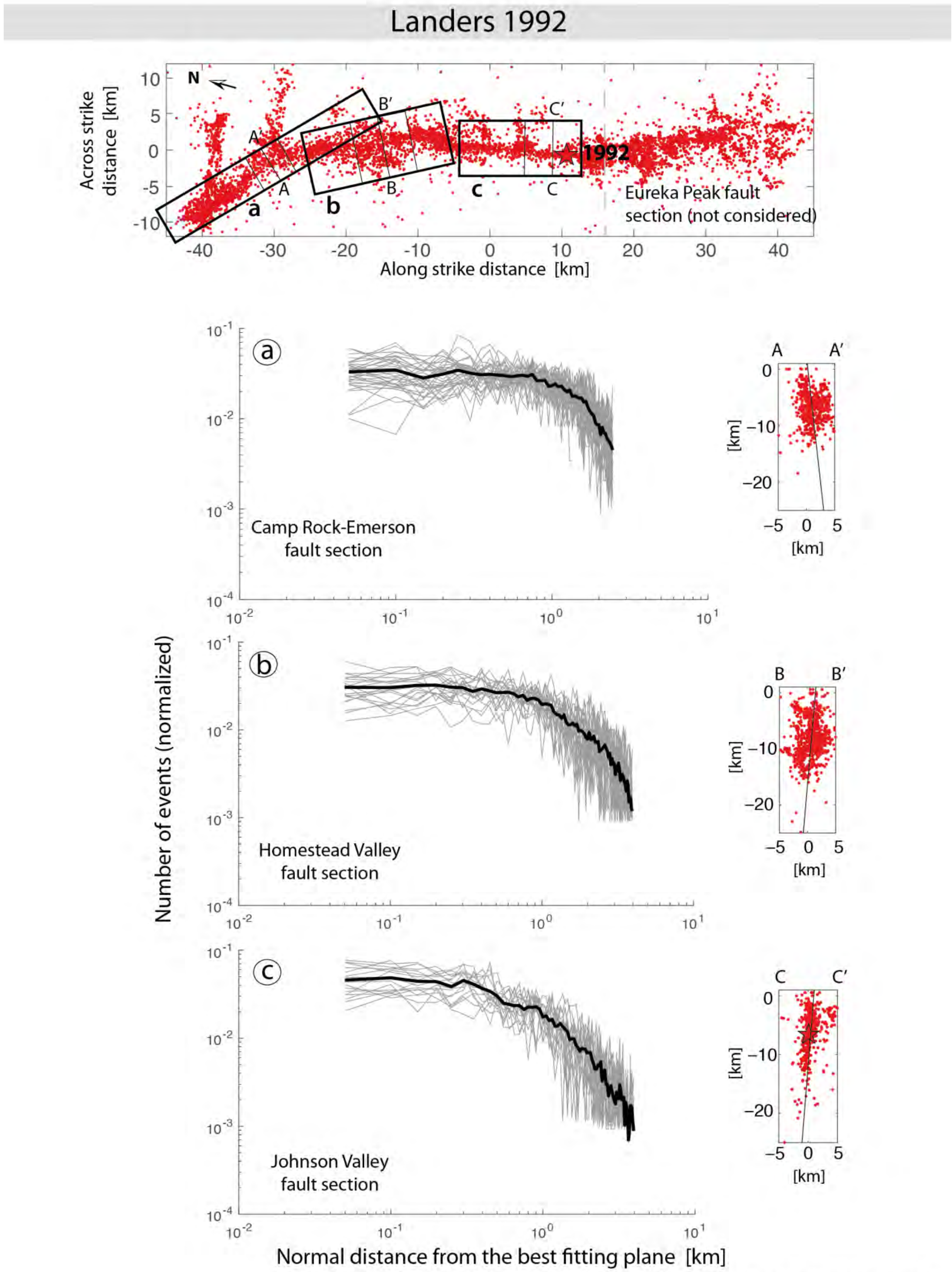
Contents of this file

Introduction

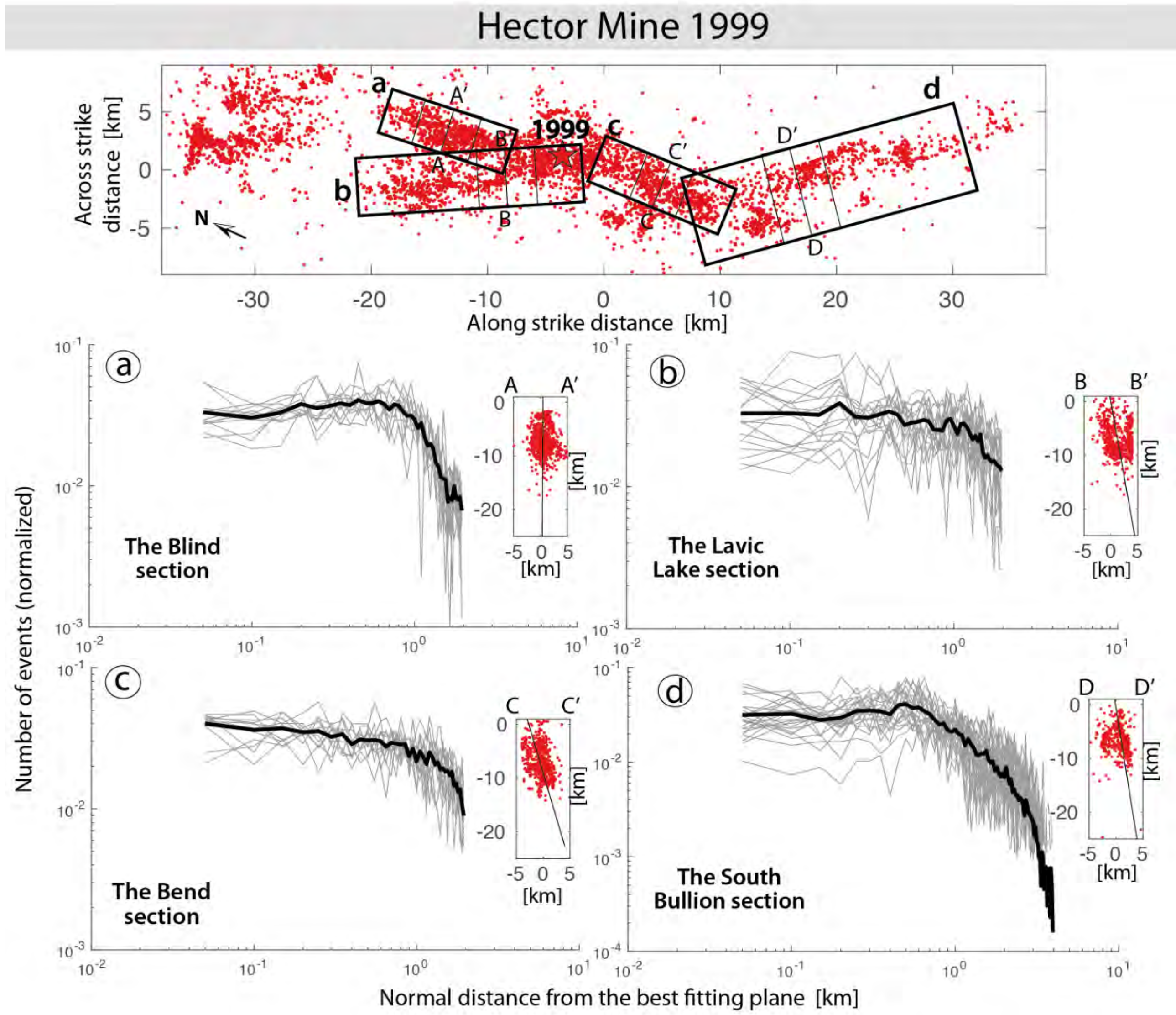
The Supporting Information includes two figures denoted Supplementary Figure S1 and S2 that provide the analysis of the across-strike aftershock distributions for the eight earthquake cases. Supplementary Figure S3 and S4 show other correlations between the size of the shear deformation zone determined from the aftershock distributions and independent geological parameters such as the initiation age and slip rate of the faults, respectively.



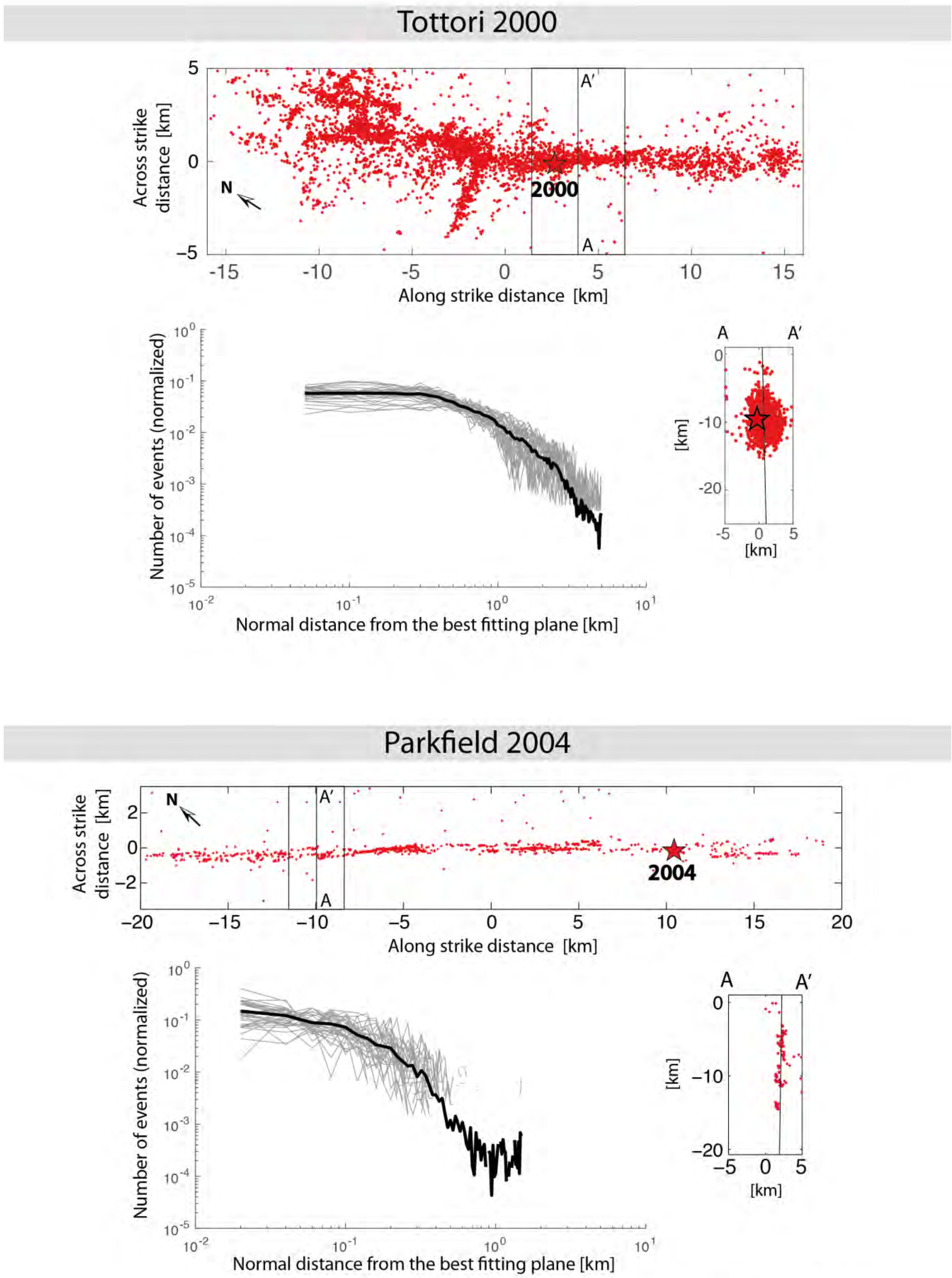
Supplementary Figure S1; Perrin et al.



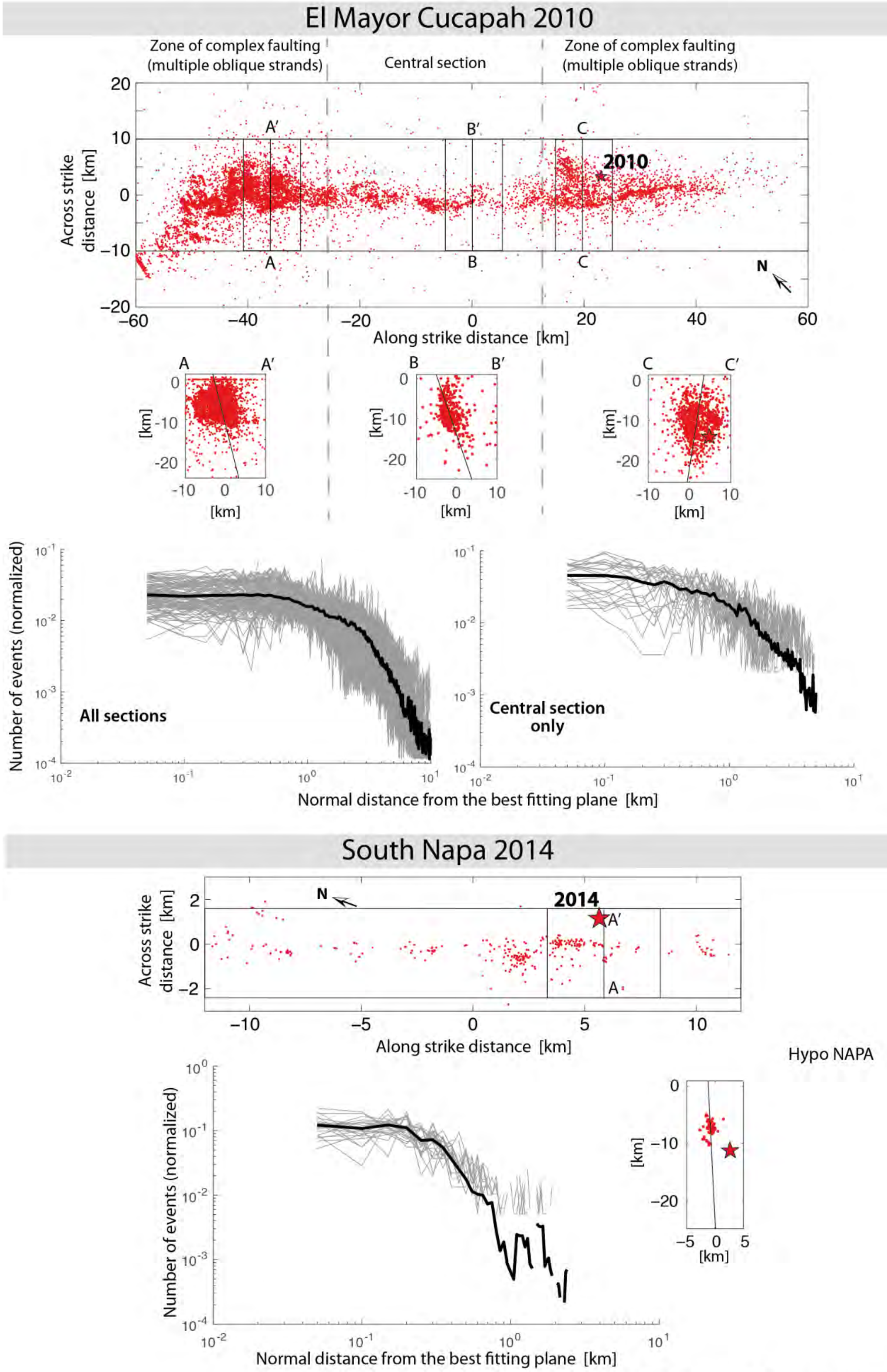
Supplementary Figure S1 (following); Perrin et al.



Supplementary Figure S1 (following); Perrin et al.



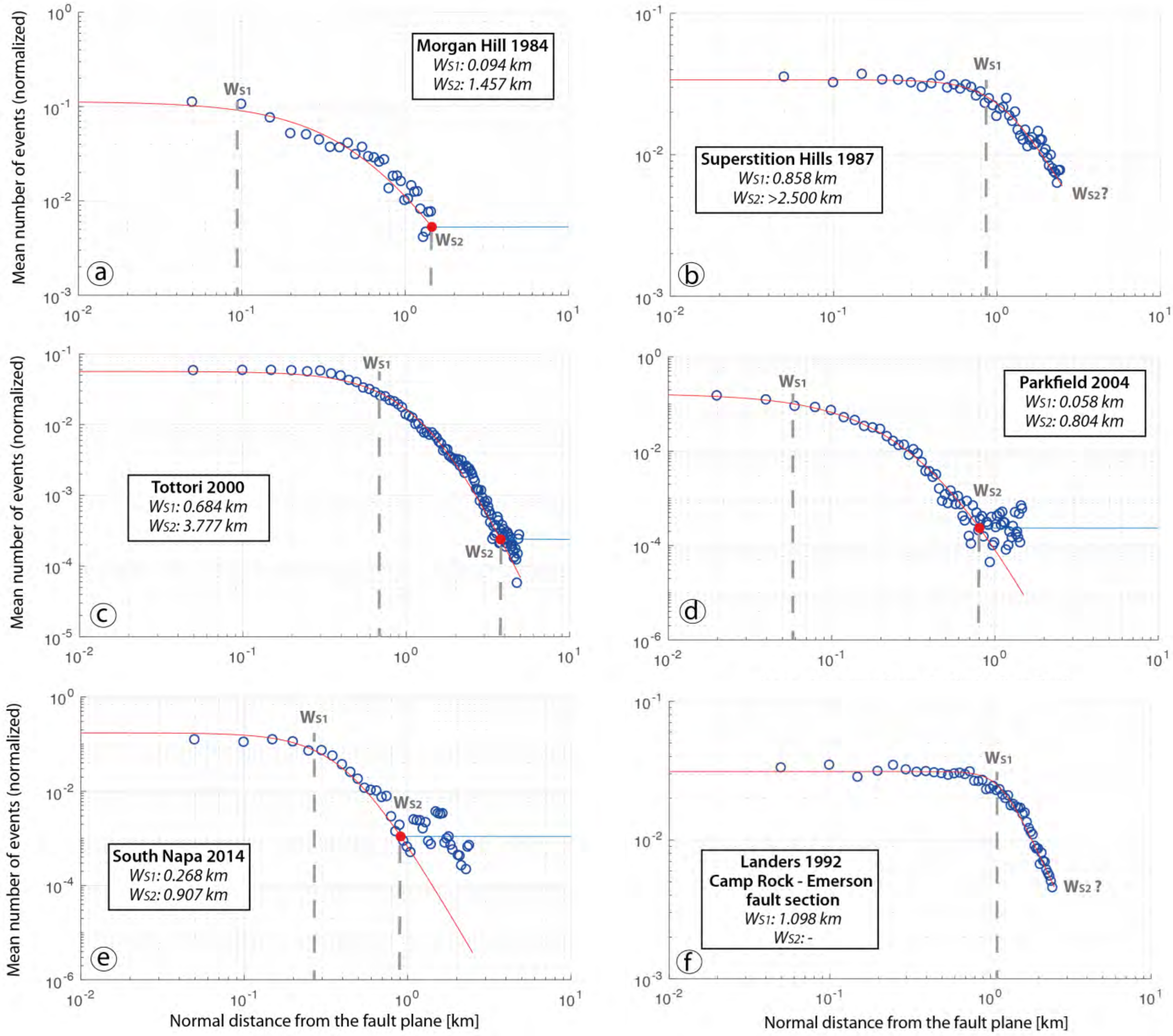
Supplementary Figure S1 (following); Perrin et al.



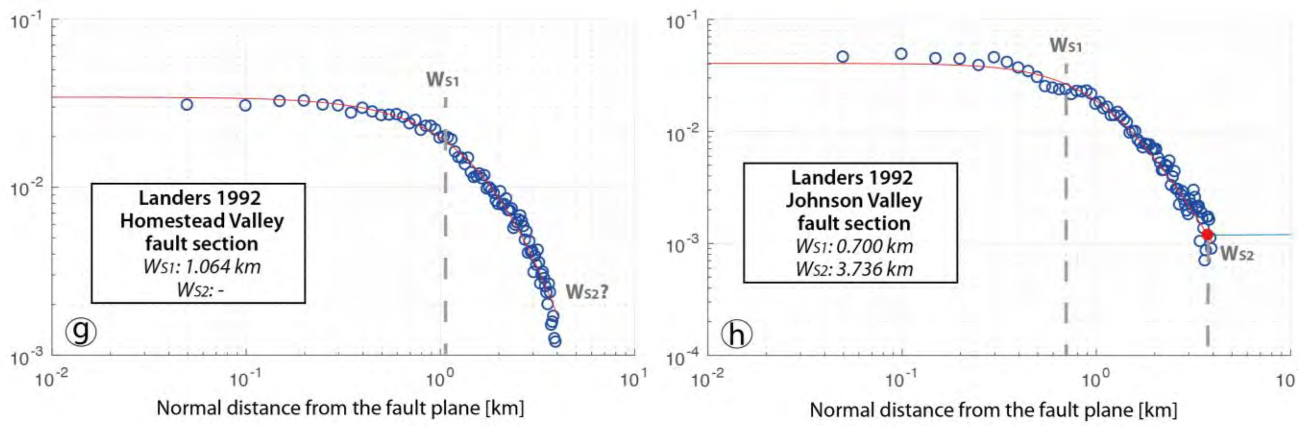
Supplementary Figure S1 (following); Perrin et al.

33

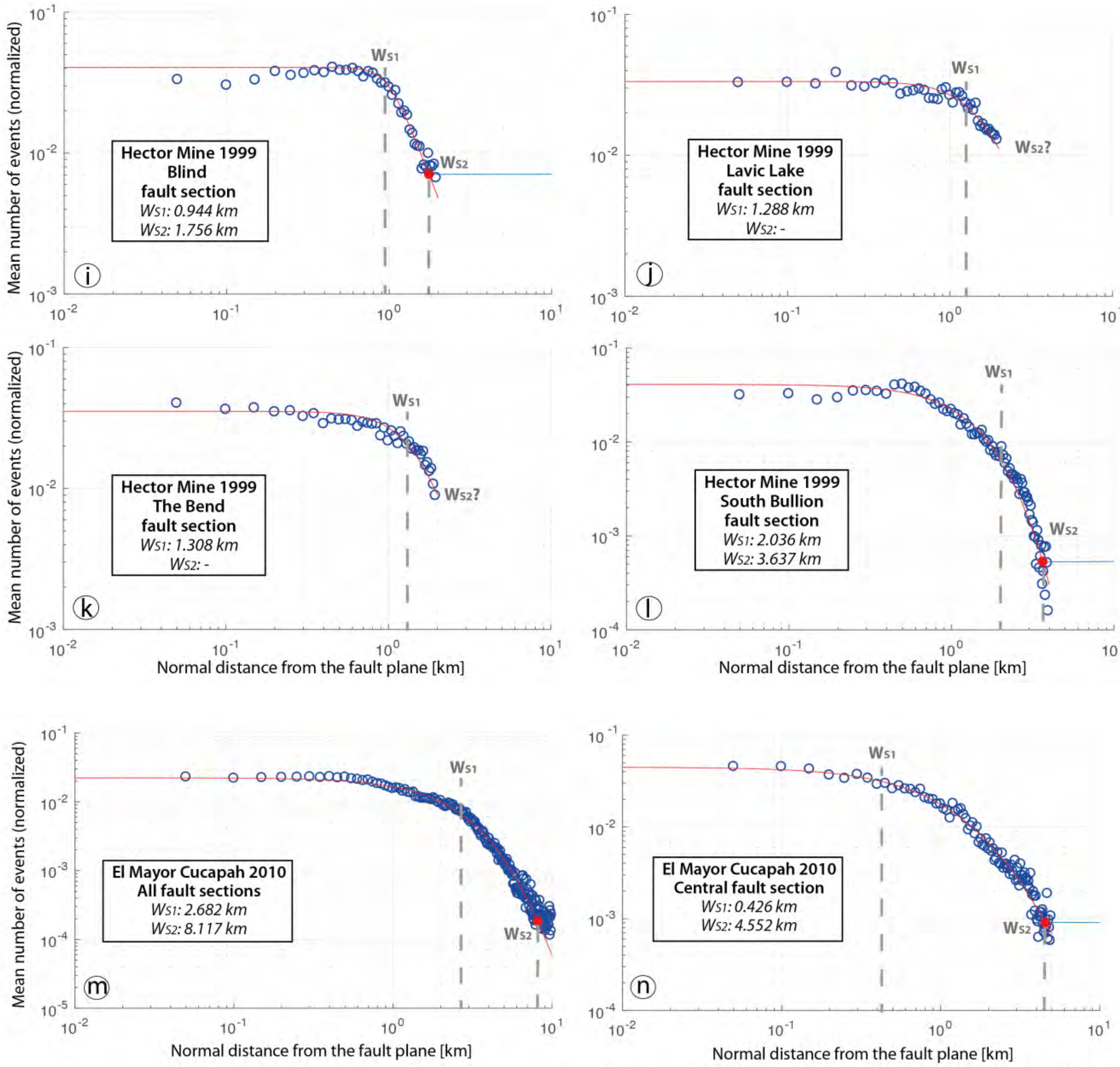
<u>Supplementary Figure S1</u>: Aftershock distributions of the eight earthquakes analyzed in this study (Morgan Hill 1984, Superstition Hills 1987, Landers 1992, Hector Mine 1999 Tottori 2000, Parkfield 2004, El Mayor Cucapah 2010 and South Napa 2014). (Top panels) Map view of the distribution of aftershocks (red dots) during the 2 months following the mainshock (red star) for each earthquake. If indicated, the thick black box shows the area selected to perform our analysis. (Bottom panels) Fault normal aftershock distribution (grey curves) measured from the best fitting plane in each box moving along the rupture trace. Black curves are the mean of the grey profiles. The small insets show selected cross sections going through the aftershock sequence (for locations see top panel). Depth in y-axis; across strike distance in x-axis. The black line is the plane best fitting the aftershocks using PCA (red dots).



Morgan Hill 1984
Ws1: 0.094 km
Ws2: 1.457 km
Superstition Hills 1987
Ws1: 0.858 km
Ws2: >2.500 km
Tottori 2000
Ws1: 0.684 km
Ws2: 3.777 km
Parkfield 2004
Ws1: 0.058 km
Ws2: 0.804 km
South Napa 2014
Ws1: 0.268 km
Ws2: 0.907 km
Landers 1992
Camp Rock - Emerson
fault section
Ws1: 1.098 km
Ws2: -
Mean number of events (normalized)
Normal distance from the fault plane [km]

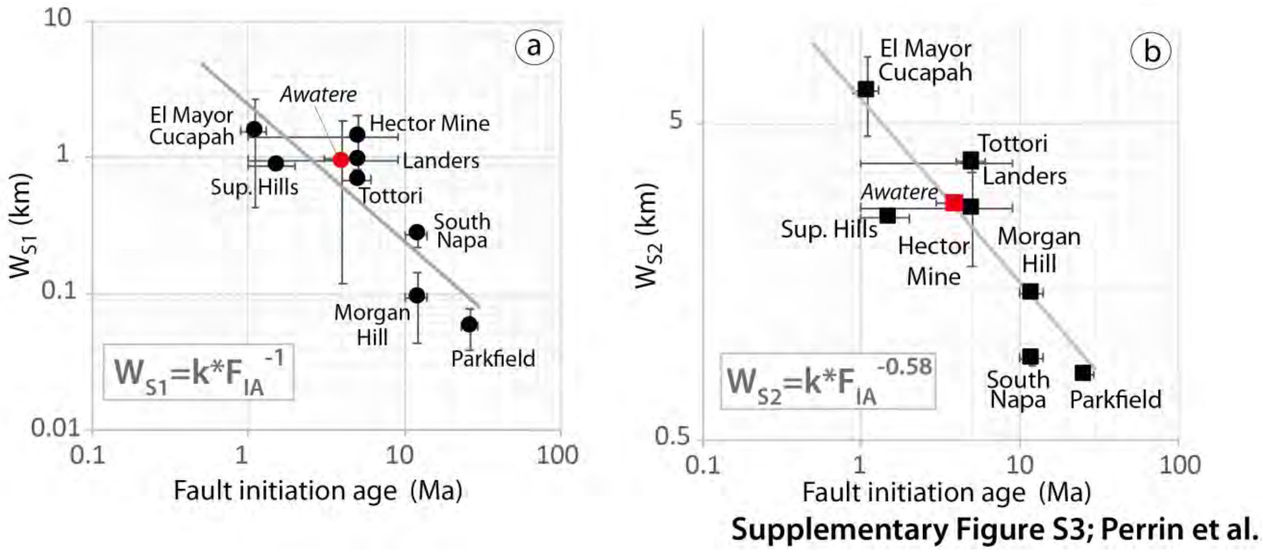


Landers 1992
Homestead Valley
fault section
Ws1: 1.064 km
Ws2: -
Landers 1992
Johnson Valley
fault section
Ws1: 0.700 km
Ws2: 3.736 km
Normal distance from the fault plane [km]

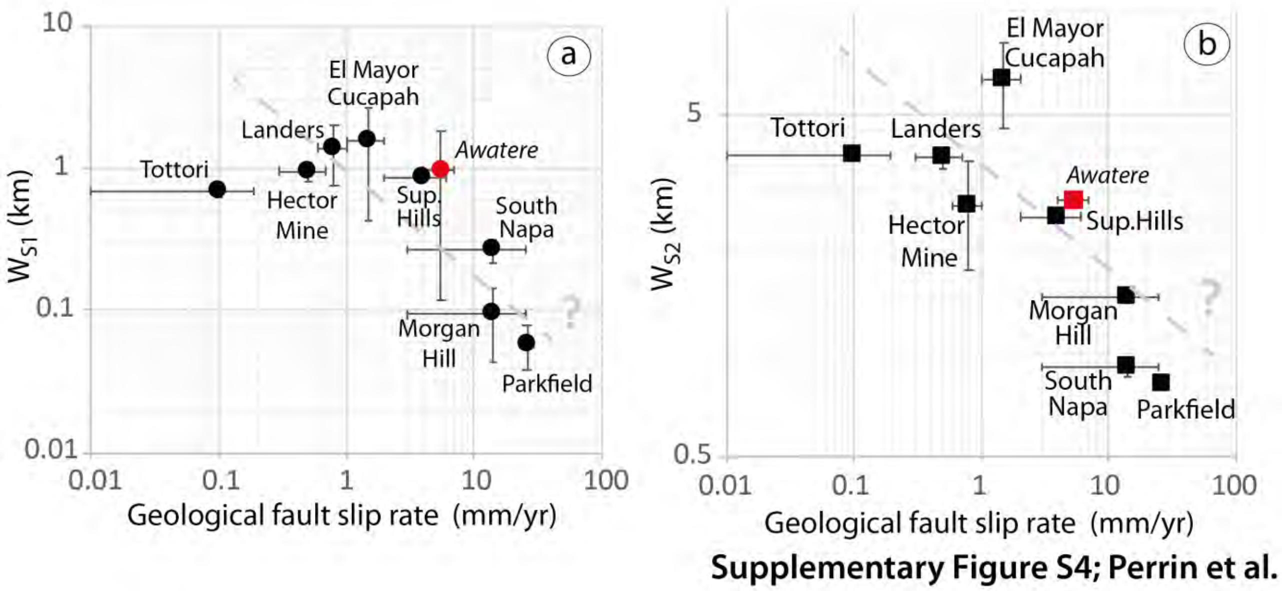


Supplementary Fig. 2 ; Perrin et al. (following)

<u>Supplementary Figure S2:</u> Determination of W_{S1} and W_{S2} parameters from the aftershock distribution of all earthquake cases: (a) Morgan Hill 1984 (b) Superstition Hills 1987 (c) Tottori 2000 (d) Parkfield 2004 (e) South Napa 2014, (f, g, h) Landers 1992 (i, j, k, l) Hector Mine 1999 (m, n) El Mayor Cucapah 2010. Blue dots represent the mean distribution of each fault section (see black curve in Supp. Fig. S1). The red curve is the best fit of the distribution. The vertical gray dashed lines labeled W_{S1} and W_{S2} point out the locations where the numbers of earthquakes decrease rapidly and where they reach background level, respectively. W_{S1} is defined as location where the maximum in the 2nd derivative is reached. W_{S2} is defined by the red dot, which is the intersection between the red fit and the background level (horizontal blue line).



<u>Supplementary Figure S3:</u> Relations between (a) Ws1 and (b) Ws2 of the eight earthquake fault zones considered in this study and the fault initiation age. Power laws are indicated by grey lines. For comparison, red symbols indicate geological surface measurements along the Awatere fault (from Little, 1995).



<u>Supplementary Figure S4:</u> Relations between (a) Ws1, (b) Ws2 of the eight earthquake fault zones considered in this study and the geological fault slip rate. Possible power laws are suggested by grey dashed lines. For comparison, red symbols indicate geological surface measurements along the Awatere fault (from Little, 1995).