

Supporting text:

An average slip velocity in the acceleration (Mavrommatis et al. 2014) during 2007—2011 off Ibaraki Prefecture was roughly estimated as follows. The acceleration read from their paper is $a=1 \text{ mm/yr}^2$. Then, the displacements at 2007 and 2011 with respect to 1997 are $y(t=2007)=a(2007-1997)^2$ and $y(t=2011)=a(2011-1997)^2$, respectively. The displacement between 2007 and 2011, $dy=y(t=2011)-y(t=2007)=a(14^2-10^2) \doteq 100 \text{ mm}$. Therefore, the average velocity during 2007—2011, $dy/dt=100 \text{ mm}/4 \text{ yr}=25 \text{ mm/yr}$.

Supporting table and figures:

Table S1. The characteristic times used for removing postseismic deformations.

Year	1996	2000	2002	2004	2004	2007	2008
Type	SSE	Volcano	SSE	EQ	EQ	SSE	EQ
Onset	Apr 22	Jul 8	Sep 14	Sep 5	Oct 23	Jul 16	May 8
τ (days)	52	51	64	45	30	56	65

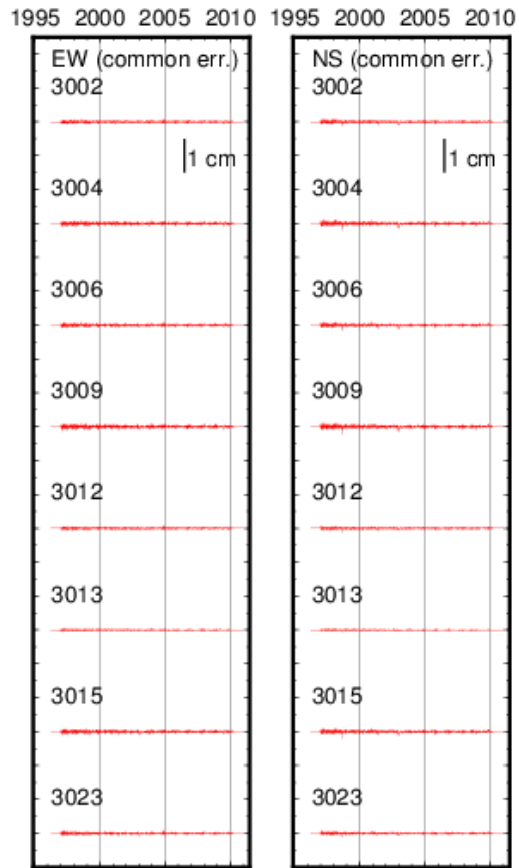


Figure S1

An example of the common errors. The locations of these GNSS stations are shown in Fig. 1 (b). The GNSS stations used for calculating the common errors were 0045, 0223, 0264, 0272, 0592, 0593, 0613, 0753, 0755, 3005, 3063 and 3065, located in the northwestern part of the area shown in Fig. 1 (b).

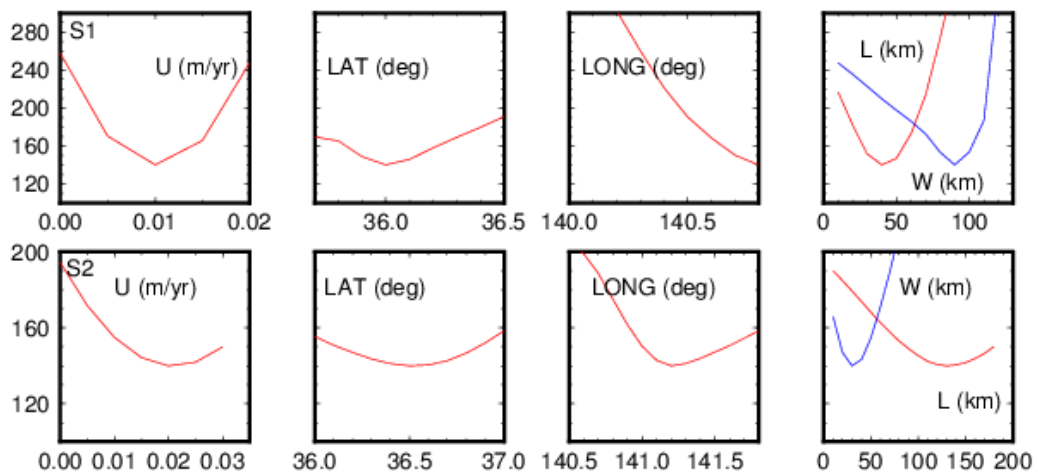


Figure S2

The normalized variances obtained by the grid search. Top/bottom 4 panels show the variances for single fault model S1/S2, inferred on the OK-PH/OK-PA boundary (Table 1). In the equation of the variance described in Method, the constant σ is being replaced with the posteriori RMS for the best-fit model (Table 1). An increase by 1 in the vertical axis means that the difference between the model and the observation at a site becomes worse by 1σ . The largest longitude for model S1 is a physical boundary of the plate interface of the PHS.

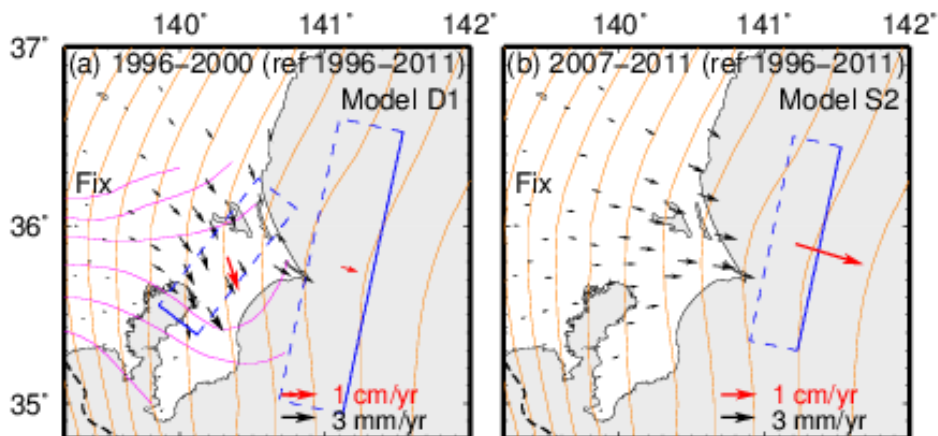


Figure S3

The same as Fig. 2 (d, f) but for double fault model D1 for period A and single fault model S2 for period B.

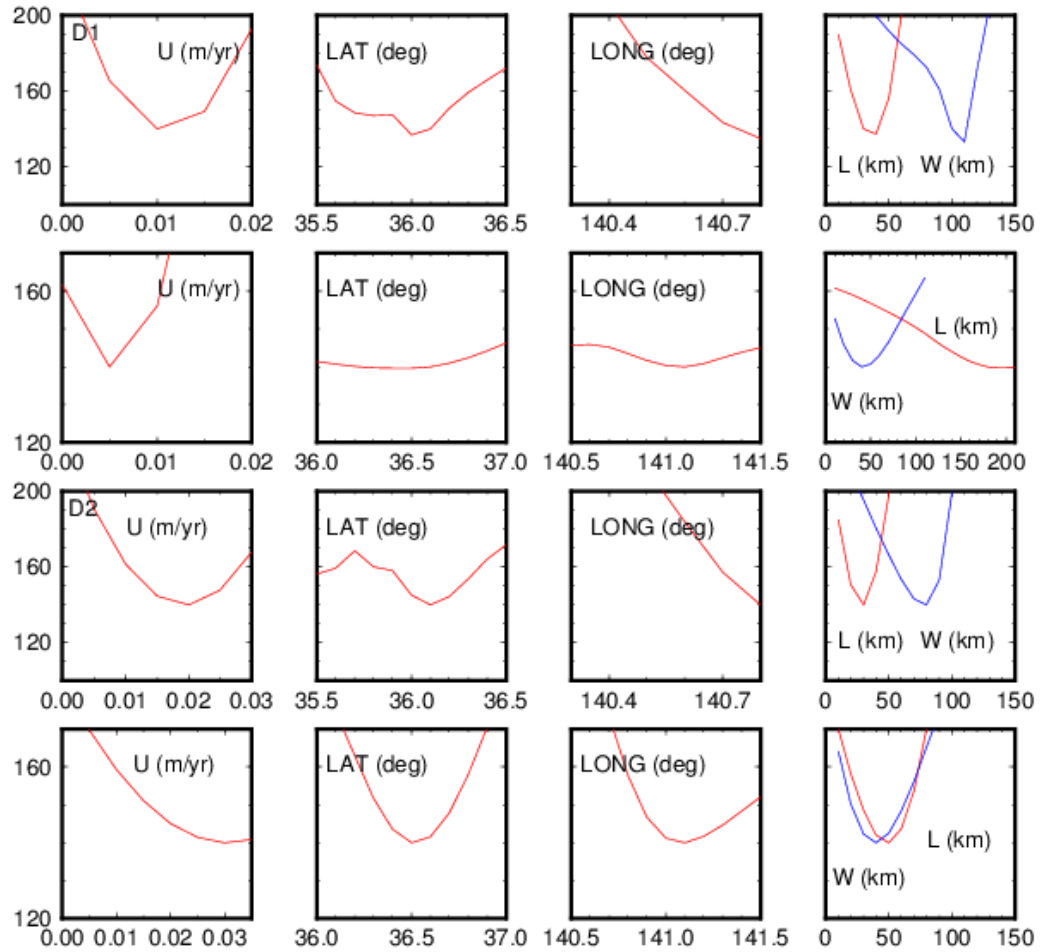


Figure S4

The same as for Fig. S3 but for the double fault model D1/D2 (top/bottom 8 panels).

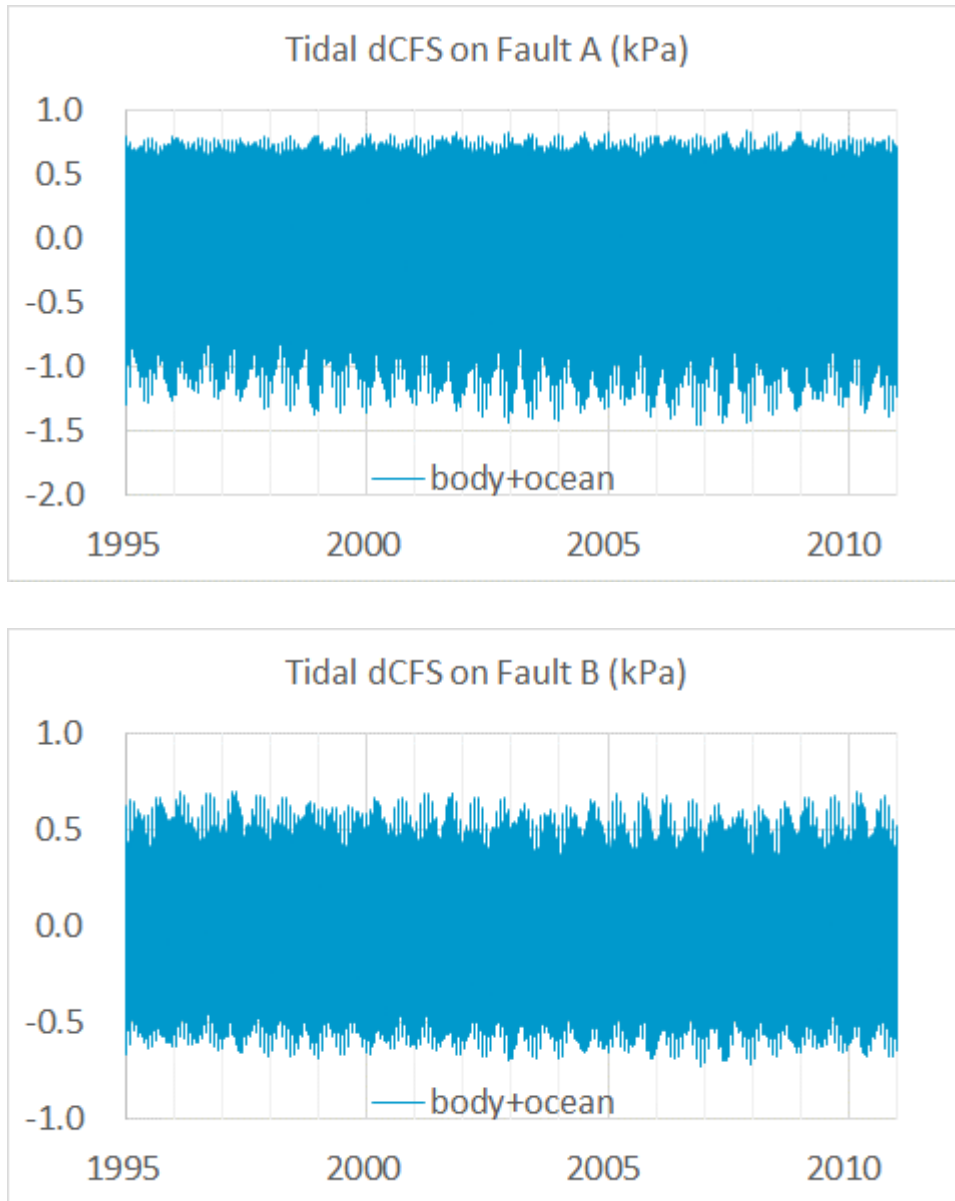


Figure S5

The Coulomb stress changes on Faults A and B, caused by tides. These changes are added to the stress changes due to the variations in the non-tidal ocean bottom pressures (Fig. 5 (a) and (b)), when calculating the slip histories shown in Fig. 5 (c) and (d). The effects of the ocean tides are larger on Fault A than on Fault B, which results in larger amplitudes of the total stress on Fault A.

