Supplementary Figures

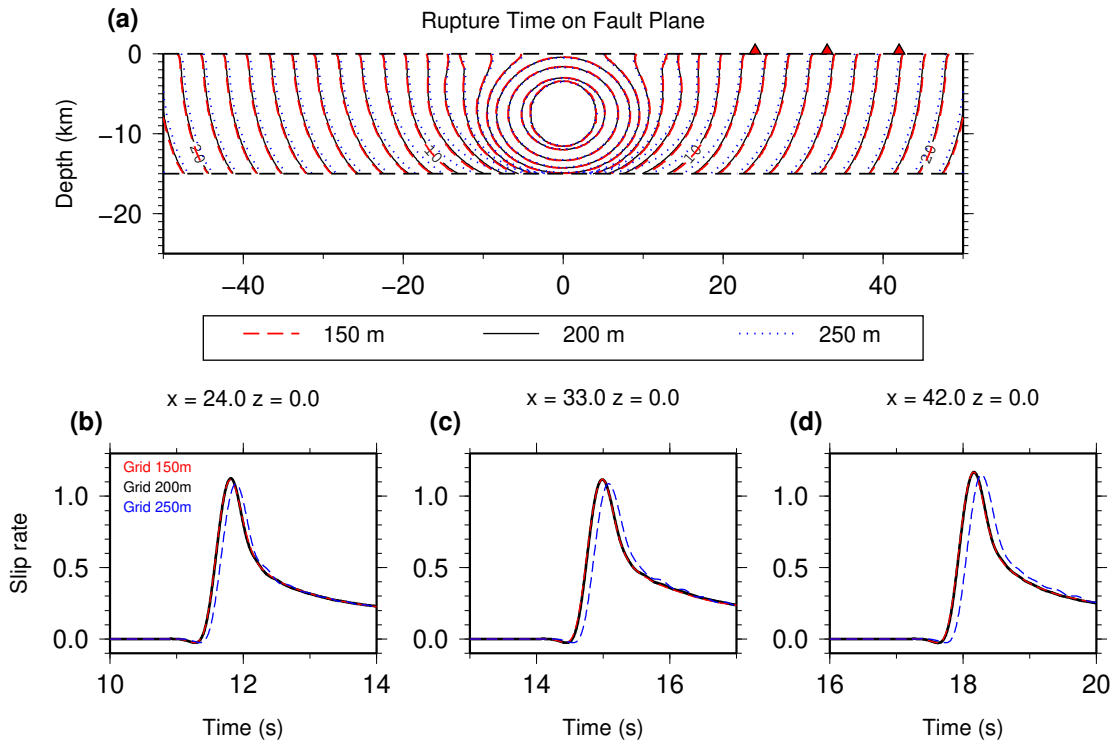

Figure S1. Comparison of simulated rupture results of different grid size. (a) Rupture isochrones contours on the fault plane in a homogeneous model with $w = 15\ km$. The red dash line, black line and blue dot line are rupture isochrones of models with grid $\Delta x = 150\ m$, $\Delta x = 200\ m$ and $\Delta x = 250\ m$, respectively. (b)-(d) are comparison of slip rate waveforms, at different locations, which is declared on the top of each subfigure. 2 Hz lowpass filter is applied to the slip rate waveforms.

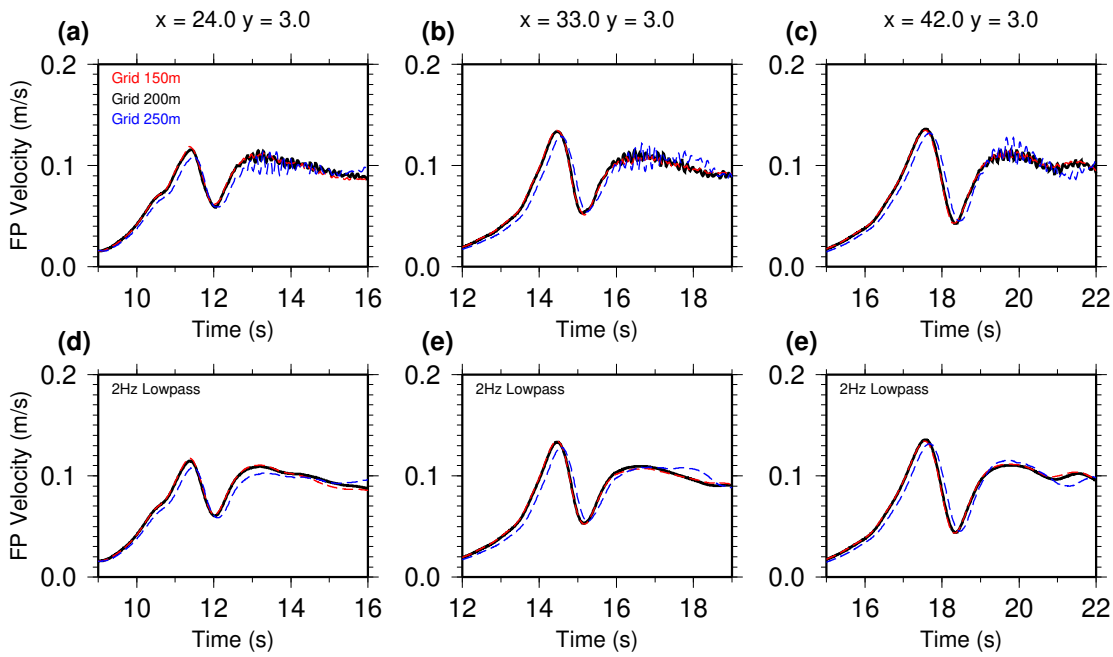

Figure S2. Comparison of simulated ground waveforms of different grid size. (a) – (c) show the raw data of fault-parallel velocity at different locations. (d) – (e) show the 2 Hz lowpass filtered waveform data. The grid location is declared on top of each column. Red, black and blue curve corresponds to the grid size of $\Delta x = 150\,m$, $\Delta x = 200\,m$ and $\Delta x = 250\,m$, respectively. The model shown in this figure is uniform with $w = 15\,km$.

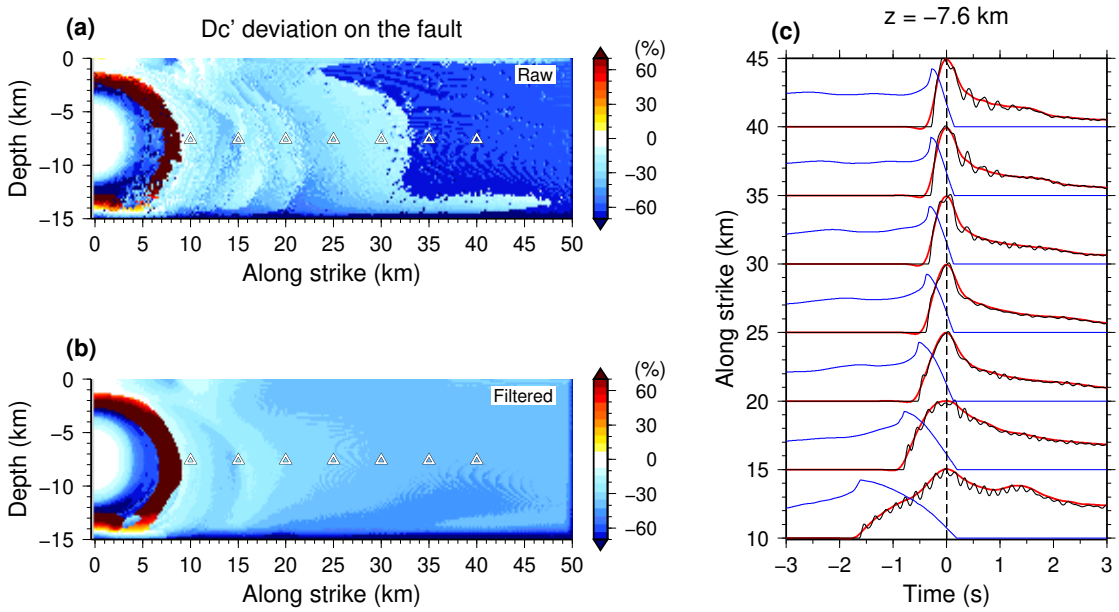

Figure S3. D_c' deviation on the fault plane. (a) D_c' deviation degree of raw data. (b) D_c' deviation degree inferred from2 Hz lowpass filtered slip rate. Triangles in (a) and (b) shows the grid locations of the waveforms in (c). (c) Slip rate waveforms and shear stress change. The waveform profile located at middle depth z = -7.6 km, shown as triangles in (a) & (b). The model shown in this figure is uniform with $w = 15\ km$.

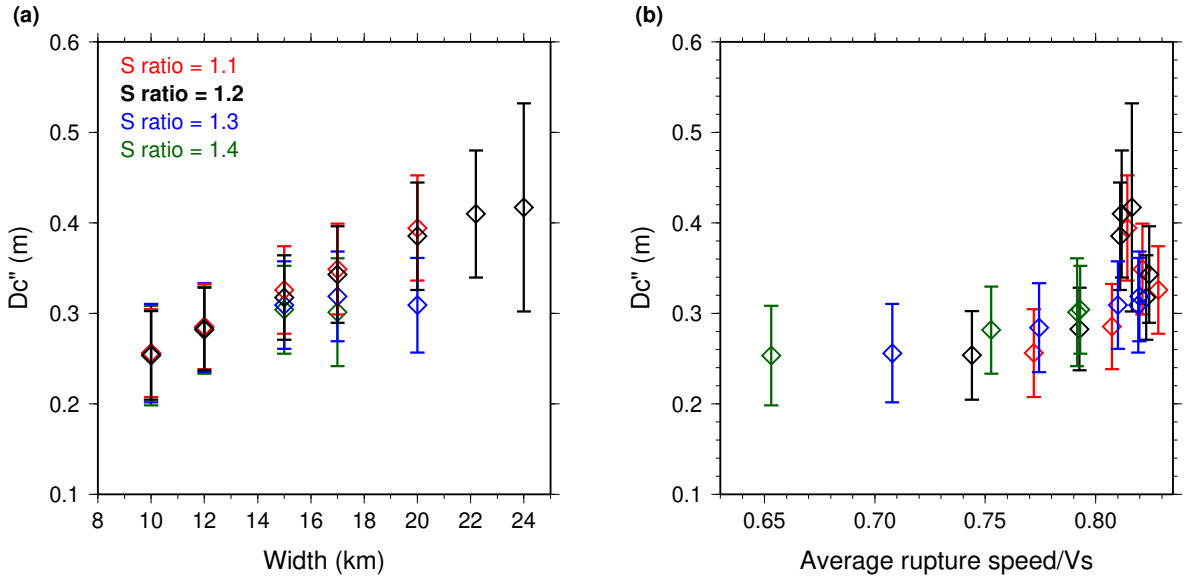

Figure S4. Average D_c'' values with different S ratio. (a) Average D_c'' versus seismogenic width. (b) Average D_c'' versus average rupture speed. The average values are calculated in the 20 km (along-strike) × 3 km (normal-to-fault) area as shown in Fig. 5. Red, black, blue and green symbols correspond to S ratio = 1.1, 1.2, 1.3 and 1.4, respectively. S ratio = 1.2 is set for all of other models in this study. Transient supershear occurs in the selected area for model with S ratio = 1.2, $w = 24\ km$. For model with S ratio = 1.4, rupture turns into self-arresting in $w = 20\ km$ model, which does not break the whole fault.

Supplementary Movies

SM1. Animation of the fault-parallel ground velocity on the ground surface and the slip rate on the fault plane. This is output from a uniform model with seismogenic width $w = 15\ km$.

SM2. Animation of the fault-parallel ground velocity on the ground surface and the slip rate on the fault plane. This is output from a model with low-velocity zone ($L_w = 2.4\ km,\ L_d = 3.0\ km$, velocity reduction is 30%).