ASPERITY LOCATIONS OF THE 2016 KUMAMOTO EARTHQUAKE USING DYNAMIC RUPTURE MODELING WITH A 3D BASIN STRUCTURE

Jikai SUN [1], ***Arben PITARKA*** [2], ***Hiroshi KAWASE*** [1]

[1] Disaster Prevention Research Institute, Kyoto University, Uji, Japan
[2] Seismology Group, Lawrence Livermore National Laboratory, Livermore, USA

contact: sun.jikai.8n@kyoto-u.ac.jp, *kawase.hiroshi.6x@kyoto-u.ac.jp*

3D simulations of the Mw 7 2016 Kumamoto earthquake are performed using dynamic rupture modeling with a slip weakening friction law and a 3D velocity model. The assumed 60 km long $\times$ 26 km wide $\times$ 25 km deep 3D velocity structure is constructed. Recorded near-fault three-components ground motions at 26 strong motion stations are used in assessing the quality of the synthetic motions and corresponding rupture models. Based on reported large slip distribution areas, two strategies for searching for the optimal three asperity locations of the mainshock are proposed (Fig. 1). A hybrid goodness-of-fit function is used to evaluate the similarity between the simulated and observed strong ground motions. Parametrical analysis suggests that the average rake angle varies between 20 and 40 degrees. According to an optimal number of successful simulations, 16 of 26 sites were found to have a good similarity between observation and synthetic waveforms. The shallow and deep asperities beneath the Futagawa fault zone with the size of 10 km in length by 6 km and 9 km in depth are located close to the hypocenter (Fig. 2). Large fault slips are mainly located in the shallow Futagawa asperity, as large as 4 m. Large fault slip rates are mostly concentrated in the deeper Futagawa asperity, as high as 6 m/s. The Kostrov-type fault slip-rate functions were found in three asperity areas, whereas the triangle (smoothed rump-function) shape slip-rate function were found in other locations. The forward rupture directivity effects produced a high fault slip-rate toward the direction of rupture propagation and strong seismic motions in Mount Aso and surrounding areas. As a consequence of both rupture directivity and wave path effects the simulated horizontal PGVs in these areas are relatively large.

Note: Figure is on the next page.

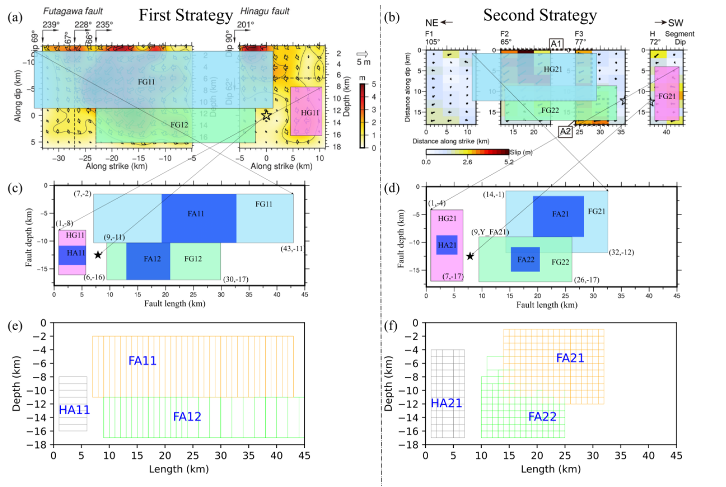

Fig. 1. Searching of SMGA locations beneath the Futagawa and Hinagu fault zones. Left and right side of dash dot line are results of first and second strategy, respectively.

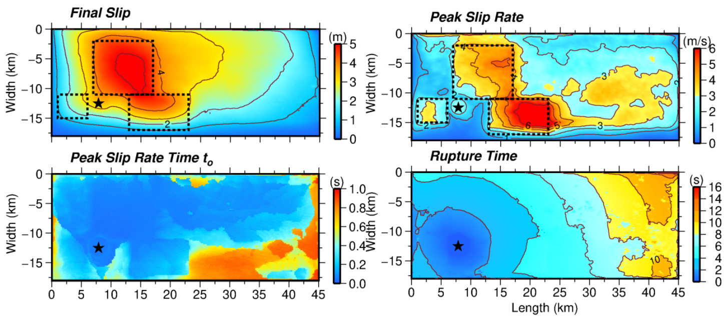

Fig. 2. Distributions of final fault slip, peak slip rate time ratio, fault slip rate, rupture time on fault plane of the optimal scenario.