1995年神戸地震の動的破壊過程

Dynamic Rupture Propagation of the 1995 Kobe Earthquake

福山 英一 [1]
Eiichi Fukuyama[1]

[1] 防災科研
[1] NIED

The 1995 Kobe (Hyogo-ken Nanbu) earthquake (Mw6.9) is one of the most famous earthquakes not only due to its serious damage in and around the Kobe area but also due to several important seismological findings. Ide and Takeo (1997, JGR) modeled this earthquake and estimated a rather long slip weakening distance at the Nojima fault (0.5~1m). Spudich et al. (1998, BSSA) estimated the low absolute stress from the change of slip direction on the fault. Yamashita et al. (2004, Science) estimated the high fault strength at the asperity (coefficient of static friction of 0.6) from the in-situ stress measurement result.

However, the initial part of the rupture did not well investigated yet. The rupture initiated at the Strait of Akashi, where the Nojima fault (southwest) and Suma fault (northeast) are intersected. Since the strike and dip angles are different between the Nojima (N45E, 75) and Suma faults (N142E, 85), the fault structure near the hypocenter is considered to be complicated but is not well investigated yet. Koketsu et al. (1998, EPS) improved the kinematic model by Yoshida et al. (1996, JPE) taking into account the crustal deformation near the hypocenter. They proposed a vertical strike slip fault segment striking N78E between the Nojima and Suma faults, which was required to explain the crustal deformation near the hypocenter.

Based on the Koketsu model, I constructed a fault model including 4 fault segments with different strike/dip directions and computed several dynamic rupture propagations using the boundary integral equation method (Fukuyama et al., 2002, AGU). The results suggest that if the rupture started either on the Nojima or the Suma fault, the jointed strike slip fault segment never rupture, which is inconsistent with the observation shown by Koketsu et al. (1998). If the rupture initiated at the jointed strike slip fault, the rupture propagated along both the Nojima and Suma faults. In this case, to make the rupture initiate and propagate along the jointed strike slip fault, the maximum principal stress direction should be rotated clockwise from the tectonic one in this region (E-W). This result suggests a local variation of the stress field at the hypocentral area. I would speculate the cause of this stress rotation might be due to the pre-slip occurring either on the Nojima or the Suma fault.