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Source Process Analysis of the 1995 Kobe Earthquake Using 3-D Velocity Structures

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The Kobe (Hyogo-ken Nanbu) earthquake with a JMA magnitude of 7.3, which occurred on 17 January 1995 near the Akashi Strait located in the southern part of Hyogo Prefecture, caused great disaster. The notable feature of this earthquake is violent ground motions with a JMA intensity of 7 occurred in a narrow zone, called ”damage belt”. Previous studies (e.g., Kawase, 1996; Furumura and Koketsu, 1998) have shown that their occurrence is attributed to the 3-D velocity structure in this zone. This indicates not only that a 3-D velocity structure significantly affects strong ground motions, but also that we should consider its effects in precisely determining the rupture process of this earthquake. However, the previous studies of source process analyses only used 1-D or half-space velocity structure models.

In this study, we calculated 3-D Green’s functions for the strong-motion and geodetic stations located in the Osaka basin using a 3-D velocity structure model. Then, we performed a joint inversion of strong motion data, teleseismic body waves and static displacements for the source model of the earthquake. Before performing the inversion, we validated the 3-D velocity structure model and refined it using the strong motion data of aftershocks.

We compared our source model to that of Yoshida *et al.* (1996), which is one of the previous studies. The seismic moment and largest slip in our source model are slightly larger than those of Yoshida *et al.* (1996). Distinctive differences are seen in between our source model and that of Yoshida *et al.* (1996): a new large-slip zone beneath the city of Kobe and larger slips in the shallow part along the Nojima fault. These differences suggest that our source model is more consistent with the violent ground motions in the ”damage belt” and the surface rupture of the Nojima fault. We also confirmed that our source model realized better fit to the strong motion observations.

Keywords: Source process, Joint inversion, 3-D Green’s function, Velocity structure