S152-005 Room: IC Time: May 18 10:00-10:15

Source Process and Fault Geometry of the 2003 Bam, Iran, Earthquake

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We attempt to determine precise fault geometry and source process of the December 26, 2003 Bam earthquake from southeast Iran, and answer the question why a moderate event (Mw 6.5) resulted in such a large disaster. Previous studies showed that the earthquake was caused by a subsurface rupture on previously unknown strike-slip fault. The strong motion station located inside the heavily damaged area of the city of Bam in vicinity of the fault recorded PGA value of 988 gal in the UD component and two pulses with a dominant frequency of 1 Hz in the horizontal components.

We inverted teleseismic and strong motion data to determine fault configuration and source process of the 2003 Bam earthquake. To infer the general rupture process we first analyzed teleseismic dataset, applying the moment tensor analysis and source inversion method developed by Kikuchi and Kanamori (1982, 1991) and Kikuchi et al. (2003) to 23 P- and 17 SH- far-field displacement waveforms from IRIS-DMC database. The hypocenter location and the initial fault dimensions of 25 km in length by 20 km in width were determined based on the aftershock studies of Nakamura et al. (2005) and Suzuki et al. (2004). The result of the teleseismic source inversions shows the slip distribution that confirms a single asperity, as suggested by Yamanaka (2003), with the rupture propagated S-N direction along almost vertical strike-slip fault. The hypocenter depth of the best model is estimated to be 8 km. In the next step, we applied the inversion method of Yoshida et al. (1996) to strong motion records of BHRC stations from Iran. We used three components of velocity records at BAM, ABR, and MOH stations to infer the precise epicenter location and rupture velocity. According to our analysis, a single fault model derived from aftershock distribution by Nakamura et al. (2005), can explain both the directivity and double pulses for three components at BAM station, rather than a single fault model estimated from geodetic analyses. We also determined the rupture velocity that minimizes the residuals between observed and synthetic waveforms to be 2.9 km/s. This agrees with the result of the Rayleigh-like speed of the rupture pointed out by Bouchon et al. (2006). Finally, we inverted the teleseismic and strong motion datasets jointly in order to obtain a stable source model for the 2003 Bam event. We estimated seismic moment of 6.94 x 10ˆ18 Nm (Mw 6.5), total rupture duration of 12 s, and the maximum slip of around 1.2 m.

Several fault models of this event have been proposed from geodetic data inversions (Talebian et al., 2004; Wang et al., 2004; Fielding et al., 2005) and aftershock analyses (Nakamura et al., 2005). They are varying significantly in there location and some of them suggest existence of the fault branching towards the north, beneath the city of Bam. The applicability of these models have to be examined, however our joint inversion result shows that both teleseismic and strong motion datasets can be explained by a single fault model with a single asperity and rupture propagation towards S-N direction. We propose the combination of the forward directivity effect, large speed of the rupture front, and the variation of the rake angles as one of the plausible explanations of the strong motion characteristics inside the city of Bam.