[JJ] Evening Poster | S (Solid Earth Sciences) | S-SS Seismology

[S-SS14]Strong Ground Motion and Earthquake Disaster

convener:Masayuki Kuriyama(Central Research Institute of Electric Power Industry)
Tue. May 22, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

Strong ground motion has social impacts as it induces earthquake disasters. We solicit contribution on any seismological topics related to strong ground motion that includes, but are not limited to, source processes, wave propagation, and site effects. We also welcome contribution on earthquake related disaster mitigation.

[SSS14-P32]Investigation of slip in shallower region than the seismogenic layer for the inland crustal earthquakes

*Ken Miyakoshi[1], Takashi Kumamoto[2], Yasuhiro Matsumoto[3] (1.Geo-Research Institute, 2.Okayama Univ., 3.Kozo Keikaku Engineering Inc.)

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After the 1995 Hyogo-ken Nanbu earthquake (Mw6.9) in Japan, the dense strong ground motion networks (K-NET, KiK-net) were installed with about 20 km intervals by NIED (National Research Institute for Earth Science and Disaster Prevention) and strong ground motion data are observed near source region. During the 2016 Kumamoto earthquake (mainshock; Mw7.1, 16th. April), large permanent displacement of about 1m or 2m was observed at Miyazono in Mashiki town or Komori in Nishihara village, respectively. To explain these observed permanent displacements, Matsumoto et al. (2016) shows that the LMGAs (Long-period Motion Generation Area) in shallow region have slip of about 2 - 4m with rise time for 2 - 3s. In this study, we investigate slip in shallower region than the seismogenic layer for the inland crustal earthquakes.

Matsuda (1975) proposed the empirical relation between fault displacement (Ds) and JMA magnitude (Mj). Applying the empirical relation (Takemura, 1990) between JMA magnitude (Mj) and seismic moment (Mo), Matsuda’s empirical relation of Ds-Mj is converted into the one of Ds-Mo as follows equation.

log Ds [m] = 0.5123 x log Mo [Nm] - 9.4974 (1)

Eq. (1) has good agreement with observed fault displacement (Ds) databases compiled from Murotani et al. (2015) or Wesnousky (2008). These databases include the maximum fault displacement of surface (Murotani et al., 2015).

Next we compare between Eq. (1) and the permanent displacement (Dp) observed from seismometer near fault within about 2km. Because of the permanent displacement of seismometer is unilateral slip of fault dislocation, two times permanent displacement (2Dp) is equal to fault displacement (Ds). Underground slip in shallow region is equal to two times permanent displacement (2Dp). Eq. (1) has almost agreement with two times permanent displacement (2Dp) compiled from Xio et al. (2010) or Boore (2010).

Eq. (1) has the slope of about 1/2 (0.5123) for the seismic moment (Mo). Based on the 3-stage source scaling of rupture area (S) and seismic moment (Mo) (HERP, 2017), the scaling relation between average slip (D) in rupture area and seismic moment (Mo) has the slope of 1/2 (0.5) in the 2nd. stage scaling as follows equation.

log D [m] = 0.5 × log Mo [Nm] – 9.6297 (Mw>6.5) (2)

Applicability range of Eq. (1) is assumed to be limited in the 2nd. stage scaling that the surface rupture earthquakes will occur, slip in shallower region than the seismogenic layer is about two times average slip (D) in rupture area from eq. (1) and eq. (2). So it is suggested that slip in LMGA is also equal to the average slip in asperity area. We need to validate this slip scaling relation for shallow region in comparison with the geological survey results of surface rupture fault. In the next step we will discuss whether shallow slip has depth dependency or not, and what size is shallow slip area (LMGA).

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