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Controls on distribution and scale of earthquake-induced landslides caused by the Iwate-Miyagi Inland earthquake in 2008, Japan

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The Iwate-Miyagi Inland earthquake on June 14, 2008 (MJMA7.2) occurred in eastern Japan, induced a large number of landslides, caused serious damages to focal region. In this study, to clarify the spatial distribution and scale of earthquake-induced landslides, we conducted aerial photographic interpretation and field investigations. The landslides distribution and scale as a function of distance from the source fault (surface projection of tip of source fault) and epicenter, landslides distribution with the peak ground acceleration of the mainshock were analyzed.
Based on aerial photographic interpretation, a total of 136 landslides interpreted from the study area, most of the landslides (97.1%) occurred on the hanging wall. The result of analyses between landslides distribution and distance from surface projection of source fault model (ERI, 2008) showed that most of the landslides (99.3%) occurred within 20 km from the source fault. The number and scale of landslides tend to decrease with increase of the distance from source fault. Landslide concentration (landslide/km2) determined by 1 km wide concentric bands extend from surface projection of the source fault. Landslide concentration has a peak at 11 km from the fault and sharp decrease from the distance of 19 km. The distributing and scaling characteristics of earthquake-induced landslides with source fault are possible to be controlled by the hanging-wall and footwall effects of the PGA, according to the measurement of PGA showed higher vertical and horizontal PGA on the hanging-wall than that on the foot wall.
The landslides distribution as a function of distance from the epicenter showed a tendency that landslides scale decrease with the increase of distance, but there were large-scale landslides far from the epicenter. The landslide concentration determined by 1 km wide concentric bands extend from the epicenter also showed a gradual decreasing with the increase of the distance.
The result of overlapping of earthquake-induced landslides with the PGA (combined value, from the KIK-NET and K-NET of NIED, 2009) showed that most of the landslides occurred in the area where the PGA larger than 500 gal. This result coincided with previous studies in eastern Japan (e.g., Has et al., 2008), indicating that larger than 500 gal of PGA is likely to cause intensive landslides by inland earthquake in Japan.
The results showed that reverse fault earthquake induce more landslides on the hanging-wall of source fault. The distance from source fault, distance from the epicenter and PGA distribution were considered to act as factors to control the distribution of landslides. The results suggested that in cases of similar magnitude earthquakes, above factors are considerable to be used for estimation of earthquake-induced landslides distribution.